JOINT DISTRIBUTIONS OF NON-PARAMETRIC

STATISTICS

JOINT DISTRIBUTIONS OF SEVERAL NON-PARAMETRIC

STATISTICS

AND TESTS BASED ON THEM

by

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SCOPE AND CONTENTS:

This thesis deals with joint distributions of several non-parametric statistics, and considers certain tests based on them. It also discusses the question of determining significance probability bounds for any observation on the basis of the joint distribution.

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CONTENTS

CHAPTER I

INTRODUCTION

Consider two random samples O_m: $(X_1, X_2, \ldots, X_m)$ and O_n': $(X_1', X_2', \ldots, X_n')$ of size m and n drawn from populations having continuous distribution functions F(x) and F'(x) respectively, where $F'(x) = F(x + \Delta)$, for testing the hypothesis H_0: $\Delta = 0$ against the two-sided alternative H_1: $\Delta \neq 0$ or against the one-sided alternative H_2: $\Delta > 0$. Besides the well known parametric tests, where the form of F and F' are known, several non-parametric tests exist. Some of these tests which are involved in the results of the following chapters are briefly described below. These tests have been discussed in [1], [9], and [19]. Since most of the tests are very well known we have not provided a complete historical bibliography.

In the following discussion let $(X_{(1)}, X_{(2)}, \ldots, X_{(m)})$ denote the order statistics of O_m formed by arranging $X_1, X_2, \ldots, X_m$ in the ascending order of magnitude; $X_{(i)}$ being the ith order statistic of O_m. Similarly we represent the order statistics of O_n' by $(X'_{(1)}, X'_{(2)}, \ldots, X'_{(n)})$. The joint order statistics of O_m and O_n' obtained by pooling O_m and O_n' together and arranging them in the ascending order of magnitude is denoted by $(Z_1, Z_2, \ldots, Z_{m+n})$. Let R_i stand for the rank of $X_{(i)}$ in $(Z_1, Z_2, \ldots, Z_{m+n})$.

KOLMOGOROV-SMIRNOV TEST

The empirical distribution function $F_m(x)$ of O_m is defined as;

$$(1.1) \qquad F_m(x) = \begin{cases} 0 \text{ for } x < x_{(1)} \\ \frac{i}{m} \text{ for } x_{(i)} \leqslant x < x_{(i+1)} \quad i = 1, 2, \ldots, m-1 \\ 1 \text{ for } x \geqslant x_{(m)}. \end{cases}$$

$F'_n(x)$, the empirical distribution function of O'_n is also defined similarly.

The Kolmogorov-Smirnov statistic to test H_0 against H_1 is

$$(1.2) \qquad K = \sup_x \left| F'_n(x) - F_m(x) \right|.$$

The critical set of K (following the usage in [19]) at level α is $\left\{ K : \quad K \geqslant \delta(m, n, \alpha) \right\}$ where $\delta(m, n, \alpha)$ is the smallest integer for which

$$P\left[K \geqslant \delta(m, n, \alpha) \right] \leqslant \alpha.$$

For the one sided test of H_0 against H_2, the statistic used is K^+ where

$$(1.3) \qquad K^+ = \sup_x \left\{ F'_n(x) - F_m(x) \right\}.$$

The rejection region corresponds to large values of K^+.

These tests are consistent and are sensitive to any difference in the two populations. Smirnov has derived an asymptotic expression for $P\left[K > 2\sqrt{\frac{1}{m} + \frac{1}{n}} \right]$ under fairly general conditions. Simpler proofs of this derivation have been provided subsequently by Feller [5] and Doob [3].

MEDIAN TEST

Several non-parametric tests based on the median of $Z_1, Z_2, \ldots, Z_{m+n}$ are known. However we shall confine our attention to the one given in [9], where the test statistic S is defined by,

$$(1.4) \quad S = \sum_{i=1}^{m} \frac{1}{2} \left[\text{sign} \left\{ R_i - \frac{1}{2}(m + n + 1) \right\} + 1 \right]$$

$$\text{with sign } x = \begin{cases} 1 \text{ for } x > 0 \\ 0 \text{ for } x = 0 \\ -1 \text{ for } x < 0. \end{cases}$$

Let S^* be the number of X - s exceeding the median $\bar{Z}$ of $Z_1, Z_2, \ldots, Z_{m+n}$. It is readily seen that S in (1.4) can be expressed in terms of S^* as

$$(1.5) \qquad S = \begin{cases} S^* + \frac{1}{2} \text{ if } m + n \text{ is odd and } \bar{Z} \in Om \\ S^* \text{ otherwise.} \end{cases}$$

The S -statistic may be used to test H_0 against H_1 or against H_2. In the former the critical region corresponds to both tails of S, each of size $\frac{\alpha}{2}$, whereas in the latter only the right tail area of size α is taken. This is primarily a test for differences in location.

TESTS BASED ON THE NUMBER OF EXCEEDANCES

Define

(1.6) A = Number of $X -s > X'_{(n)}$

B = Number of $X' -s < X_{(1)}$

A' = Number of $X' -s > X_{(m)}$

B' = Number of $X -s < X'_{(1)}$.

Haga test [8] is based on the statistic H where

(1.7) $$H = A + B - A' - B'.$$

The critical region for the two-sided test for H_0 against H_1 at level α is determined by

(1,8) $$|H| \geqslant h_1(m, n, \alpha), \text{ where}$$

$h_1(m, n, \alpha)$ is the minimum value for which

(1.9) $$P\left[H \geqslant h_1(m, n, \alpha)\right] \leqslant \frac{\alpha}{2}.$$

To test H_0 against H_2 we consider only the right tail values of T. Haga test is sensitive to differences in the location parameter of F and F'.

For testing H_0 against H_2 Tukey [14] has suggested a simpler statistic;

(1.10) $$E = A + B.$$

Here H_0 is rejected for large values of E . This is the locally most powerful rank test for certain distributions.

RANK-SUM TEST

The test statistic for rank-sum test, suggested by Wilcoxon [17] is

(1.10) $$T^* = \sum_{i=1}^{m} R_i.$$

To test H_0 against H_2, the critical region is given by

(1.11) $$T^* \geqslant t_1(m, n, \alpha), \text{ where } t_1(m, n, \alpha)$$

is the largest integer, satisfying

(1.12) $$P\left[T^* \geqslant t_1(m, n, \alpha)\right] \leqslant \frac{\alpha}{2},$$

α being the level of significance. For testing H_0 against H_1, both tails of the distribution of T^* are considered (each of size $\frac{\alpha}{2}$).

Mann and Whitney [10] have shown that, this test is consistent. It is sensitive to difference in the location of F and F'. In fact the test statistic used in [10] is

(1.13) $$U = mn + \frac{m(m+1)}{2} - T^* \text{ which}$$

is a linear transformation of T^*. They have also shown that U is asymptotically normally distributed.

Alternatively one may consider T, where

(1.14) $$T = T^* - \frac{m(m+1)}{2}$$

so that T ranges from 0 to mn. Obviously T has all the properties of T^*.

RUN TEST

In Z_1, Z_2, ..., Z_{m+n} replace Z_i by X or X' according as Z_i is from Om or O'_n respectively for r = 1, 2, ..., m + n. The test statistic R for the run test is defined as the number of runs of X and X' in the sequence so formed. The realisation of too few runs indicates the X -s and X' -s clustering together separately, and this leads us to doubt the validity of H_0 against H_1. The test, therefore is the region of the sample space of O_m and O'_n for which

$$R \leq r_1(m, n, \alpha) \text{ where}$$

$r_1(m, n, \alpha)$ is the largest integer for which

(1.15) $$P\left[R \leq r_1(m, n, \alpha)\right] \leq \alpha$$

α being the level of significance. Clearly run test is sensitive to differences in location as well as in the shape of F and F'. Wald and Wolfowtz [16] have shown that this test is consistent for testing H_0 against H_1, provided F and F' satisfy certain conditions. They have also shown that R is asymptotically normally distributed.

Obviously the test statistic used in each of the tests described above is a function of $Z_1, Z_2, \ldots, Z_{m+n}$. We state below a well known result [9] used in the derivation of the distributions of various test statistics.

Let I_m be any subset of size m of the set $\{1, 2, \ldots, m+n\}$ of integers. Then under H_0,

$$(1.16) \qquad P\left[(R_1, \ldots, R_m) = I_m\right] = \frac{1}{\binom{m+n}{m}} .$$

This implies that the occurrence of m, X -s in $(Z_1, \ldots, Z_{m+n})$ in any m positions is equally probable. Thus if W is any test statistic depending on $(Z_1, \ldots, Z_{m+n})$ then

$$(1.17) \qquad P\left[W \leq w\right] = \frac{1}{\binom{m+n}{m}} \# \left\{(z_1, z_2, \ldots, z_{m+n}) : W \leq w\right\}$$

where $\# \{ . \}$ denotes the number of elements in the set $\{.\}$.

In chapter 2, Section 1 we derive exact expressions for the joint distribution of (K^+, S, E) and (K, S, H). In Section 2 we give the method used for the computation of table of joint distributions of (K^+, S, E, T) and (K, S, R). The computer programs (Fortran) and some of the tables computed as given in the appendix. In chapter 3 tests based on joint distributions are discussed. Finally, how joint distributions can be made use of, in determining significance probability bounds for any observation is also dealt with.

CHAPTER 2

JOINT DISTRIBUTIONS OF SEVERAL NON-PARAMETRIC STATISTICS

In this chapter we derive the joint distributions of some of the test statistics described in the last chapter, for equal sample sizes, say n. For this purpose we use a graphical representation of the joint order statistics $Z_1, Z_2, \ldots, Z_{2n}$ as suggested by Drion [4]. Associate with every point $(z_1, z_2, \ldots, z_{2n})$ a minimal lattice path in the (x, y) plane from (0, 0) to (n, n) by taking a horizontal or a vertical step for each z according as it is from O_n or O_n'. It is easily seen that there is a one to one correspondence between points $(z_1, z_2, \ldots, z_{2n})$ and the paths from (0, 0) to (n, n). (1.16) implies that each path from (0, 0) to (n, n) is equally likely and has probability $\frac{1}{\binom{2n}{n}}$.

The relationship between the test statistics under consideration and the paths can be demonstrated in the following table.

1. EVENT	2. Set of paths from (0, 0) to (n, n) corresponding to the event in 1.
$\left\{ K^{+} < \frac{k}{n} \right\}$	paths not touching the line $y = x + k$.
$\left\{ K < \frac{k}{n} \right\}$	paths not touching the lines $y = x \pm k$.
$\{S = s\}$	paths which pass through $(n - s, s)$.
$\{A = a\}$	paths which reach $(n - a, n)$ vertically.
$\{B = b\}$	paths which leave $(0, b)$ horizontally.
$\{A' = a'\}$	paths which reach $(n, n - a')$ horizontally.
$\{B' = b'\}$	paths which leave $(b', 0)$ vertically.
$\{T = t\}$	paths for which the area enclosed by $y = 0$, $x = n$ and the path is t.
$\{R = r\}$	paths for which the total number of changes from horizontal direction to vertical direction and vice versa is $r - 1$.

The interpretation of $\{E = e\}$ and $\{H = h\}$ is terms of paths may be seen through $\{A = a\}$, $\{B = b\}$, $\{A' = a'\}$ and $\{B' = b'\}$.

SECTION 1

In this section we give in the following theorems, the exact expressions for the distributions of (K^+, S, E) and (K^-, S, H) under H_0. However it is rather difficult to give closed expressions for the joint distribution of statistics involving T. Thus in the next section we propose to form tables of joint distributions for small sample size.

Theorem 1.

Under H_0

(2.1) $$P\left[K^+ < \frac{k}{n}, \quad S = s, \; E = e\right] = \frac{q_k}{\binom{2n}{n}}$$; k, s, e being

non-negative integers; and where

$$q_k = \begin{cases} \displaystyle\sum_{r=\max(0,e-k+1)}^{\min(k-1,e)} \left\{\binom{n-r-1}{n-s-1} - \binom{n-r-1}{s-k-1}\right\}\left\{\binom{n-e+r-1}{n-s-1} - \binom{n-e+r-1}{s-k-1}\right\} & (2.2) \\ \qquad \text{for } 0 < k \leqslant n+1, \; 0 \leqslant s < \frac{n+k}{2}, 0 \leqslant e \leqslant 2k-2 & \\ 0 \qquad \text{otherwise.} & (2.3) \end{cases}$$

Here, we assume that $\binom{a}{b} = 0$ if $a \geq 0$ and $b \geq 0$ and $a < b$ or if $b < 0$.

Proof:

Evidently q_k appearing in the statement of the theorem is the number of paths from (0, 0) to (n,n) corresponding to the event $\left\{K^+ < \frac{k}{n}, \quad S = s,\ E = e\right\}$. Denote by Q_k the set of all such paths. A path in Q_k, therefore, satisfies the following conditions:

(i) it does not touch $y = x + k$.

(ii) it passes through $(n - s, s)$, and

(iii) it leaves $(0, r)$ horizontally and reaches $(n - e + r, n)$ vertically, the range of r being discussed below.

A typical path belonging to Q_k subject to the conditions of (2.2) is OBLAC, as shown in the fig. 2.1.

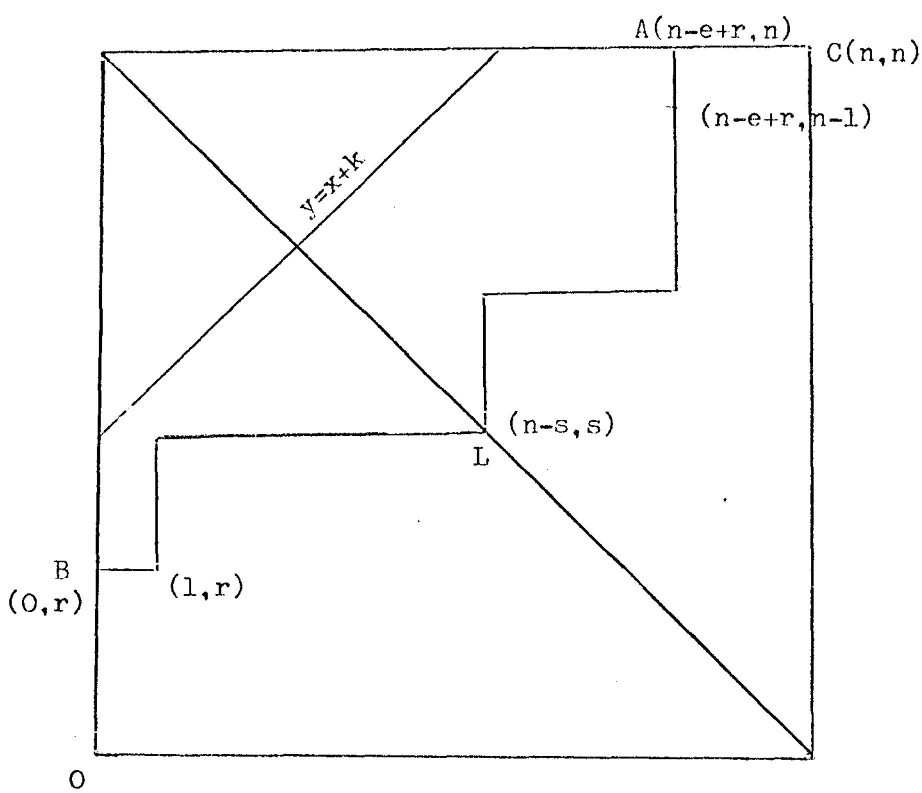


fig. 2.1

Evidently $0 \leq r \leq e$. Furthermore from (i) we get $r \leq k - 1$ and $e - r \leq k - 1$. Thus r ranges from max $(0, e - k + 1)$ to min $(e, k - 1)$.

Hence

$$(2.4) \qquad q_k = \sum_r \Big[\text{number of paths from } (1, r) \text{ to } (n - s, s) \text{ not touching } y = x + k\Big] \times \Big[\text{number of paths from } (n - s, s) \text{ to } (n - e + r, n - 1) \text{ not touching } y = x + k\Big].$$

But by reflection principle ([6] Page 72 and [4]) it can be easily seen that for two points (x, y) and (m, n) lying below $y = x + k$, the number of paths from (x, y) to (m, n) touching or crossing $y = x + k$ is $\binom{m + n - x - y}{m - y + k}$. Hence the number of paths from (x, y) to (m, n) not touching $y = x + k$ is

$$(2.5) \qquad \binom{m + n - x - y}{m - x} - \binom{m + n - x - y}{m - y + k}.$$

Therefore the expression for q_k under conditions of (2.2) is given by

$$q_k = \sum_{r=\max(0,e-k+1)}^{\min(e,k-1)} \left\{\binom{n-r-1}{n-s-1} - \binom{n-r-1}{s-k-1}\right\}\left\{\binom{n-e+r-1}{n-s-1} - \binom{n-e+r-1}{s-k-1}\right\}.$$

If $s \geq \frac{n + k}{2}$ or if $e > 2k - 2$ or when both occur, it is obvious that all paths will either touch or cross $y = x + k$. Hence $q_k = 0$, proving (2.3).

We give below the joint distributions of (K^+, S), (K^+, E)

and (E, S) in the form of a corollary.

Corollary.

1. $$\binom{2n}{n} P\left[K^+ < \frac{k}{n},\ S = s\right] = \sum_{e=0}^{2n} q_k = \left[\binom{n}{s} - \binom{n}{s-k}\right]$$

2. $$\binom{2n}{n} P\left[K^+ < \frac{k}{n},\ E = e\right] = \sum_{s=0}^{n} q_k$$

$$= \begin{cases} \displaystyle\sum_{r=\max(0,e-k+1)}^{\min(e,k-1)} \left[\binom{2n-e-2}{n-r-1} - \binom{2n-e-2}{n-k-e}\right] & \text{for } 0 \leq e \leq 2k-2 \\ 0 & \text{otherwise.} \end{cases}$$

3. $$\binom{2n}{n} P\left[E = e,\ S = s\right] = q_{n+1} = \sum_{r=0}^{e} \binom{n-r-1}{n-s-1} \binom{n-e+r-1}{n-s-1}.$$

The last expression in each case follows from the path representation in the figure.

Theorem 2.

Under H_0

(2.6) $$P\left[K < \frac{k}{n},\ S = s,\ H = h\right] = \frac{p_k}{\binom{2n}{n}}$$, k, s, e being non-negative integers, and

(2.7)
$$p_k = \begin{cases} \sum_{r_1}\left[\sum_i\left\{\binom{n-r_1-1}{s-r_1+2ik} - \binom{n-r_1-1}{s-1-(2i+1)k}\right\} \sum_i\left\{\binom{n-h+r_1-1}{n-s-1+2ik} - \binom{n-h+r_1-1}{s-1-(2i+1)k}\right\}\right] \\ +2\sum_{r_2}\left[\sum_i\left\{\binom{n-r_2-1}{s-1+2ik} - \binom{n-r_2-1}{s-r_2-(2i+1)k}\right\} \times \sum_i\left\{\binom{n-h-r_2-1}{n-s-1+2ik} - \binom{n-h-r_2-1}{s-1-(2i+1)k}\right\}\right] \\ \text{for } 2 \leq k \leq n+1,\ \frac{n-k}{2} < s < \frac{n+k}{2},\ 0 \leq h \leq 2k-2 \\ \text{and} \\ 0 \text{ otherwise.} \end{cases}$$

(2.8)

In $\sum$ r_1 ranges from max (1,h-k+1, h-s)to min(h-1, k-1, s) and

r_2 ranges from 1 to min (k-h-1, n-s, s-h).

Proof: p_k is obviously the number of paths corresponding to the event $\left\{K < \frac{k}{n}, S = s, H = h\right\}$. Let P_k denote the set of all such paths.

The event $\{H = h\}$ can arise in three mutually exclusive ways [8] as indicated below.

(i) $h = a + b$, $a' = b' = 0$.

In fig. 2.2 OBLAC is a typical path of this kind.

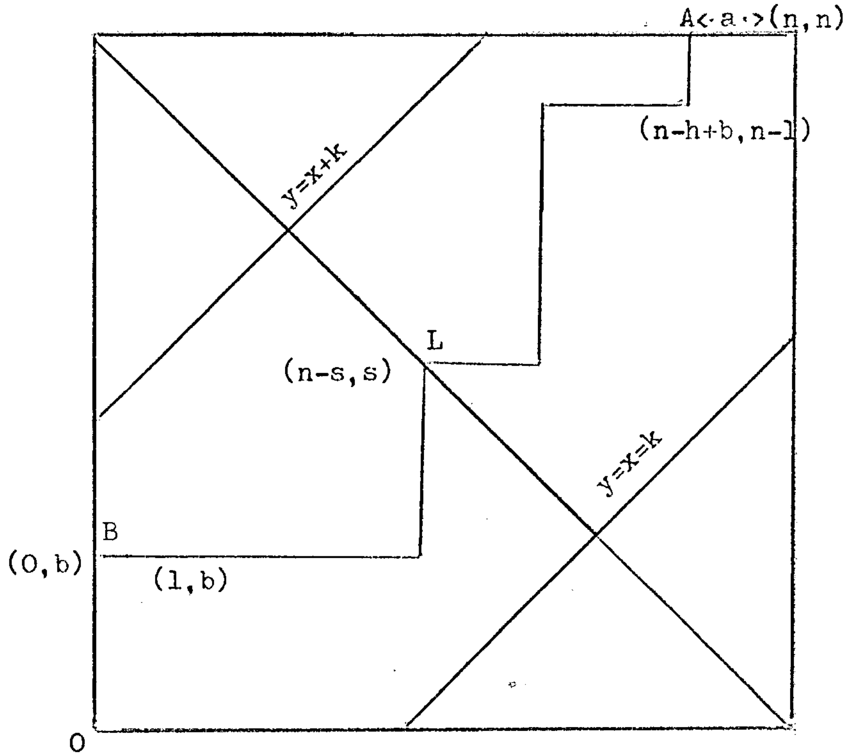


fig. 2.2

Under conditions of (2.7) let us examine the range of b. $1 \leq b \leq h - 1$, moreover $b \leq k - 1$ and $h - b \leq k - 1$ since a path belonging to P_k has to pass through $(n-s, s)$, it follows that

$$b \leq s \text{ and } h - b \leq s.$$

Therefore b ranges from max (1, h - k + 1, h - s) to min(h - 1, s, k - 1).

(ii) h = a - b' and a' = b = 0.

A typical path of this type is OBLAC in fig. 2.3. A similar examination shows that b' ranges from 1 to min(k - h - 1, s - h, n - s).

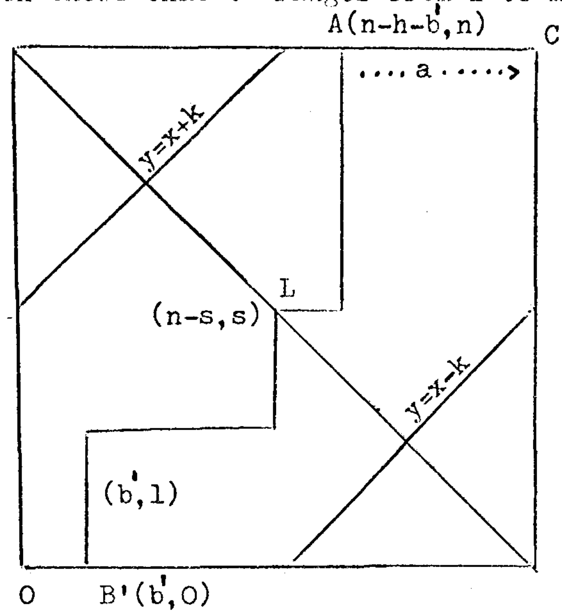
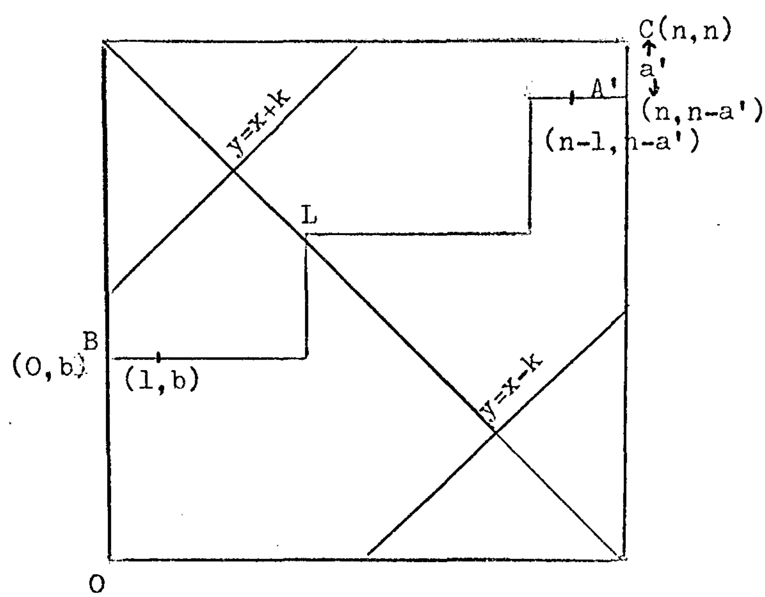


fig. 2.3

(iii) h = b - a', a = b' = 0.

Here OBLA'C is a typical path, and one can easily verify that a' has the range as b' in (ii).



Therefore

p_k = sum of the number of paths of (i), (ii), (iii) passing through (n - s, s) and not touching the lines $y = x \pm k$.

$$= \sum_{r_1} \{\text{number of paths from } (1, r_1) \text{ to } (n-s, s) \text{ not touching } y = x \pm k\} \times \{\text{number of paths from } (n-s, s) \text{ to } (n-h+r_1, n-1) \text{ not touching } y = x \pm k\}.$$

$$+ \sum_{r_2} \Big[\{\text{number of paths from } (r_2, 1) \text{ to } (n-s, s) \text{ not touching } y = x \pm k\} \times \{\text{number of paths from } (n-s, s) \text{ to } (n-h-r_2, n-1) \text{ not touching } y = x \pm k\} + \{\text{number of paths from } (1, h+r_2) \text{ to } (n-s, s) \text{ not touching } y = x \pm k\} \times \{\text{number of paths from } (n-s, s) \text{ to } (n-1, n-r_2) \text{ not touching } y = x \pm k\} \Big].$$

where the ranges of r_1 and r_2 are as in (2.7).

Theorem 3 of Takacs [13] can be restated as follows:

For two points (x, y) and (m, n) lying inside the region formed by $y = x \pm k$ the number of lattice paths from (x y) to (m, n) not touching $y = x \pm k$ is

$$(2.10) \quad \sum_i \left[\binom{m+n-x-y}{m-x-2ik} - \binom{m+n-x-y}{m-y+(2i+1)k} \right]$$

where i ranges from $\max\left(-\left[\frac{n-y}{2k}\right], -\left[\frac{m-y+k}{2k}\right]\right)$ to $\min\left(\left[\frac{m-x}{2k}\right], \left[\frac{n-x-k}{2k}\right]\right)$.

Expression (2.7) for p_k follows when (2.10) is used in (2.9). The last part of the theorem is obvious.

The following results giving expressions for the joint distributions of (K , H), (K , S) and (S, H) under H_0 can be stated as corollaries.

Corollary.

1. $\binom{2n}{n} \quad P\left[K < \frac{k}{n}, H = h\right] = \sum_{s=0}^{n} p_k = \pi_k$

where

$$\pi_k = \begin{cases} \sum_{r=\max(1,h-k-1)}^{\min(h-1,k-1)} \left[\sum_i \left\{ \binom{2n-h-2}{n-2+2ik} - \binom{2n-h-2}{n-r-1-(2i+1)k} \right\} \right] \\ +2 \sum_{r=1}^{k-h-1} \left[\sum_i \left\{ \binom{2n-h-2r-2}{n-2+2ik} - \binom{2n-h-2r-2}{n-r-1-(2i+1)k} \right\} \right] \\ \text{for } 1 < k \leq n+1 \quad 0 \leq h \leq 2k-2 \\ \text{and} \\ 0 \text{ otherwise.} \end{cases}$$

2. $\binom{2n}{n} \quad P\left[K < \frac{k}{n}, S = s\right] = \sum_{h=0}^{2n} p_k = \phi_k$

where

$$\phi_k = \begin{cases} \left[\sum_i \left\{ \binom{n}{s-2ik} - \binom{n}{s-(2i+1)k} \right\} \right]^2 \\ \text{for } 1 < k \leq n+1 \quad \frac{n-k}{2} < s < \frac{n+k}{2} \\ \text{and} \\ 0 \text{ otherwise.} \end{cases}$$

3. $\binom{2n}{n} P\left[S = s,\ H = h\right]$

$$= p_{n+1} = \sum_{r=\max(1,h-s)}^{\min(h-1,s)} \binom{n-r-1}{n-s-1} \binom{n-h+r-1}{n-s-1}$$

$$+ 2 \sum_{r=1}^{\min(s-h,n-s)} \binom{n-r-1}{s-1} \binom{n-h-r-1}{n-s-1} .$$

Here too the last expression in each case follows directly by reasoning based on the path representation.

SECTION 2

As mentioned earlier, here we first attempt to derive the joint distribution of K^+, S, E and T. We have already observed that the derivation of joint distributions of test statistics essentially involves the enumeration of paths from (0, 0) to (n, n). Here too we shall have a similar counting proceedure. However, it has not been possible to give an exact expression for the distribution of T. Therefore by using a recurrence relation [10], tables of distribution of T for $m \leq n \leq 8$ have been computed. Wilcoxon, Katti and Wilcox [17], give the critical values and probability levels for T for one sided as well as two sided tests for sizes 0.01, 0.02, 0.05, 0.10 for sample sizes $m = n = 3$ to $m = n = 50$ including all combinations of m and n within these limits. Here they have resorted to the method of generating functions. Milton [11] by making use of difference equations has computed the critical values of T which can be used for one sided as well as two sided tests of sizes 0.0005, 0.0025, 0.005, 0.001, 0.01, .025, 0.1 for $m \leq 20$, $n \leq 40$. As the joint distribution under consideration involves T, we are interested in preparing similar tables for small sample sizes.

For our purpose, let N(x, y, k, b, t) denote the number of paths from (0, 0) to (x, y) not crossing $y = x + k$, with $B = b$ and $T = t$. Evidently it satisfies the recurrence relation:

$$N(x, y, k, b, t) = N(x - 1, y, k, b, t - y) + N(x, y - 1, k, b, t) \tag{2.11}$$

with boundary conditions:

$$N(0, y, k, b, t) = \begin{cases} 1 \text{ for } y \leq k \quad b = y \quad t = 0 \\ 0 \text{ otherwise} \end{cases} \tag{2.12}$$

and

$$N(x, 0, k, b, t) = \begin{cases} 1 \text{ for } x \leq n \quad b = 0 \quad t = 0 \\ 0 \text{ otherwise.} \end{cases}$$

From (2.11) and (2.12) we first obtain $N(n - s, s, k, b, t)$ for

$$\begin{aligned} & 0 \leq k \leq n \\ & 0 \leq s \leq \frac{n + k}{2} \\ & 0 \leq b \leq \text{Min } (k, s) \\ & (n - s)b \leq t \leq (n - s)s - (s - b). \end{aligned} \tag{2.13}$$

From fig. 2.5 it is evident that the number of paths from $(n - s, s)$ to (n, n), not crossing $y = x + k$ with $A = a$, such that the area bounded by $y = s$, $x = n$, and the path is t, is the same as $N(n - s, s, k, a, t)$.

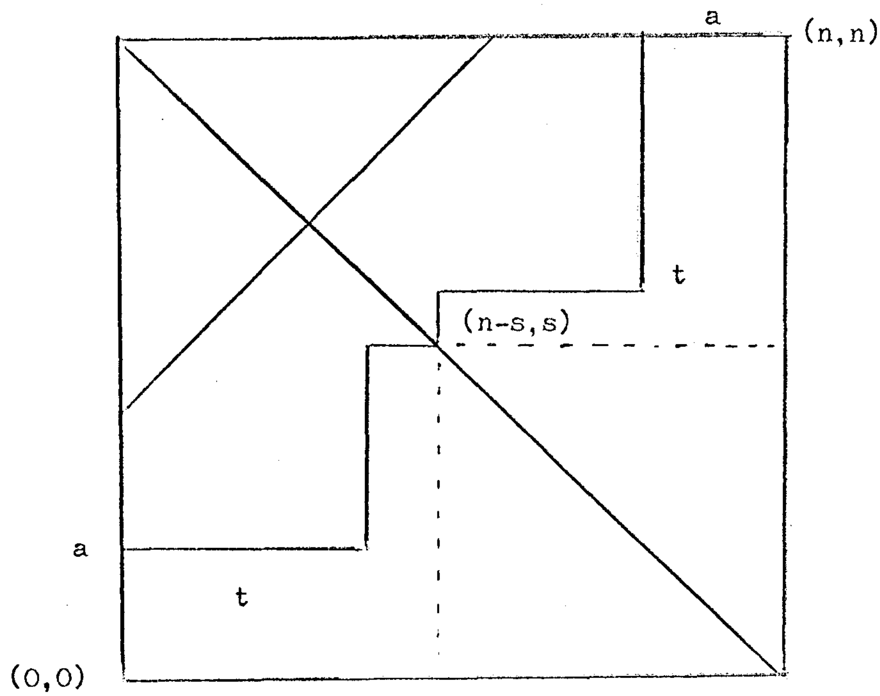


fig. 2.5

Denote by $N^*(n, n, k, s, e, t)$ the number of paths from (0, 0) to (n, n) not crossing $y = x + k$, passing through $(n - s, s)$ with $E = e$, and $T = t$. It may be readily seen that $N^*(n, n, k, s, e, t)$ corresponds to the event $\left\{ K^+ = \frac{k}{n}, S = s, E = e, T = t \right\}$. We can now get, $N^*(n, n, k, s, e, t)$ as,

$$(2.14) \quad N^*(n, n, k, s, e, t) = \sum_i \sum_j N(n - s, \quad k, i, j) \times N(n - s, s, k, e - i, t - s^2 - j)$$

where the ranges of i and j are determined by the following relations.

$$(2.15) \quad \begin{aligned} &0 \leq i \leq \min (k, s) \\ &0 \leq e - i \leq \min (k, s) \\ &(n - s)i \leq j \leq (n - s)s - (s - i) \\ &(n - s)(e - i) \leq t - s^2 - j \leq (n - s)s - (s - e + i). \end{aligned}$$

One may easily obtain values for $P\left[nK = k,\ S = s,\ E = e,\ T = t\right]$ from the above, which in fact are computed for $n \leq 20$, but are not included here because of its enormous length.

Next, we compute the joint distribution of K, S and R. Let $N(x, y, k, r)$ be the number of paths from (0, 0) to (x, y) with $nK \leq k$ and $R = r$.

Evidently

$$N(x, y, k, r) = N_1(x, y, k, r) + N_2(x, y, k, r)$$

where N_1 and N_2 are the number of paths from (0, 0) to (x, y) with $nK = k$ and $R = r$, reaching (x, y) horizontally and vertically respectively.

Obviously the following recurrence relations hold.

$$(2.16) \qquad N_1(x, y, k, r) = N_1(x - 1, y, k, r) + N_2(x - 1, y, k, r - 1)$$

$$(2.17) \qquad N_2(x, y, k, r) = N_1(x, y - 1, k, r - 1) + N_2(x, y - 1, k, r)$$

with boundary conditions

$$(2.18) \qquad N_1(x, 0, k, r) = \begin{cases} 1 \text{ for } r = 1 \text{ and } x \leq k \\ 0 \text{ otherwise} \end{cases}$$

$$(2.19) \qquad N_2(0, y, k, r) = \begin{cases} 1 \text{ for } r = 1,\ y \leq k \\ 0 \text{ otherwise.} \end{cases}$$

From (2.16), (2.17), (2.18), and (2.19) we obtain the values for

$N_1(n - s, s, k, r)$ and $N_2(n - s, s, k, r)$ for

$$
(2.20)\qquad
\begin{aligned}
&1 \leq k \leq n \\
&\frac{n - k}{2} \leq s \leq \frac{n + k}{2} \\
&1 \leq r \leq \begin{cases} 2 \min (n - s, s) + 1 & \text{for } n - s \neq s \\ 2s & \text{for } n - s = s. \end{cases}
\end{aligned}
$$

Let $N^*(n, n, k, s, r)$ be the number of paths from (0, 0) to (n, n) with $nK = k$, $S = s$, $R = r$, then

$$
\begin{aligned}
N^*(n, n, k, s, r) = \sum_i \Big[& N_1(n - s, s, k, i) . N_1(n - s, s, k, r - i) \\
& + N_2(n - s, s, k, i) . N_2(n - s, s, k, r - i) \\
& + N_1(n - s, s, k, i + 1) . N_2(n - s, s, k, r - i) \\
& + N_2(n - s, s, k, i + 1) . N_1(n - s, s, k, r - i) \Big].
\end{aligned}
$$

The range for i is determined from the fact that i as well as r - i have the same range as that of r in (2.20).

It is easily seen that $N^*(n, n, k, s, r)$ is the number of paths corresponding to $\{nK \leq k, S = s, R = r\}$. From this we get the probability for $\{nK = k, S = s, R = r\}$. Appendix D gives table of $P[nK = k, S = s, R = r]$ for $n \leq 20$, and $s \leq \frac{n}{2}$. For $s > \frac{n}{2}$, we get P from the relation,

$$P[nK = k, S = s, R = r] = P[nK = k, S = n - s, R = r].$$

It may be remarked that recurrence relations were also used by Birnbaum and Hall [2] to derive $P(nK \leq k)$ and $P(nK^{+} \leq k)$ for n = 1, to 40, and by Zayachkowski and Marliss [20] to obtain $P(K \leq \frac{k}{mn})$ for $m = n = 1$ to $m \leq n \leq 20$.

All computations have been carried out on CDC 6400 at McMaster University.

CHAPTER 3

TESTS BASED ON THE JOINT DISTRIBUTIONS

In this chapter we discuss tests based on the joint distributions derived in the previous chapter. For clarity of ideas, we may consider tests of H_0 against H_1, and for our reference give below the table of distribution of $\{K, R\}$ for n = 6, which is computed from the joint distribution of $\{K, R, S\}$.

r \ k	6	5	4	3	2	1
2	002164					
3		004329	004329	002164		
4		019480	017316	015151	002164	
5			034632	056277	017376	
6			060606	090909	064935	
7				090909	123276	002164
8				075757	129870	010822
9					086580	021645
10					023467	021645
11						010822
12						002164

Table 3.1

The basic supposition for the Kolmogorov-Smirnov test is:

$$P\left[nK = k_1 | H_1\right] > P\left[nK = k_2 | H_1\right] \quad \text{for } k_1 > k_2 \quad .$$

In other words, the probabilities of various values of K under H_1 are completely ordered, and $P(nK = k | H_1)$ decreases with k. Thus it is reasonable to construct the critical region of the Kolmogorov-Smirnov Test of size α as $\{nK \geqslant k_\alpha\}$ where k_α is the smallest integer for which

$$P\left[nK \geqslant k_\alpha | H_0\right] \leq \alpha .$$

In the example $k_{.05} = 5$.

Similarly it is reasonable to expect $P\left[R = r | H_1\right]$ to be completely ordered for different r and decreases as r increases. This led to the critical region of size α, based on R as mentioned in Chapter 1. From table 3.1 it is clear that H_0 is rejected at level .05 when the observed number of runs is less than or equal to 3. It may therefore be remarked that the ordering of various values of the statistic plays a significant role in determining a test.

The above discussion suggests us to accept the relations:

$$P\left[nK = k_1,\ R = r | H_1\right] > P\left[nK = k_2,\ R = r | H_1\right] \text{ for } k_1 > k_2 \text{ and for every } r$$

(3.1) and

$$P\left[nK = k,\ R = r_1 | H_1\right] > P\left[nK = k,\ R = r_2 | H_1\right] \text{ for } r_1 < r_2 \text{ and for every } k$$

which induce a partial ordering on the sample space. Obviously a complete ordering either for K or for R follows directly from these. Thus one is motivated to consider a test based on a new statistic which under some alternative may induce a complete ordering on the sample space. For example let, (3.2) $$L = R - 2 + n - nK.$$

Suppose for a specified alternative $H_1^* \subset H_1$,

(3.3) $$P[L = \ell_1 | H_1^*] > P[L = \ell_2 | H_1^*] \text{ for } \ell_1 < \ell_2.$$

Then the rejection region of size α based on L is given by $\{L \leq \ell_\alpha\}$ where ℓ_α is the largest integer such that

$$P[L \leq \ell_\alpha | H_0] \leq \alpha.$$

In the example one can verify that $\ell_{.05} = 4$.

Observe that the sample point corresponding to $\{nK = 4,\ R = 4\}$ lies in the critical region of the test based on L, whereas it does not lie in the critical region of the test based on either K or R. We shall come to this point later.

The test statistic nK varies from 1 to n, and R ranges from 2 to 2n, while L ranges from 0 to 3n - 3. Thus L partitions the sample space into larger number of regions then the other two. Moreover since K, R and L are discrete, the probability of the critical region under H_0 (level attained), seldom reaches the size say α. From these two remarks we may expect

(3.4) $$P[L \leq \ell_\alpha | H_0] \geq P[nK \geq k_\alpha | H_0]$$

$$P[L \leq \ell_\alpha | H_0] \geq P[R \leq r_\alpha | H_0]$$

to hold good more often, which implies that the power of the L-test is likely to be more than that of the other tests.

For $\alpha = .05$, that (3.4) holds in the example is easily seen.

Analogous to L, we may consider tests based on the joint distribution of several statistics. For instance, to test H_0 against some altenative $H_2^* \subset H_2$, we may construct a test statistic L^* as a function of K^+, S, E and T as

$$L^* = n^2 + 4n - nK^+ - S - E - T,$$

which is very much similar to L, provided,

$$P[L^* = \ell_1^* \mid H_2^*] > P[L^* = \ell_2^* \mid H_2^*] \text{ for } \ell_1^* < \ell_2^*.$$

Table 3.2 gives $P[nK^+ = k, S = s, E = e, T = t]$ for $n = 5$. The corresponding table of $P[L^* = \ell^*]$ may be referred to in appendix B.

Table of $P(nK^{+} = k, S = s, E = e, T = t) .10^{6} = \mathfrak{p}$ for n = 5.

k	s	e	t	p	k	s	e	t	p	k	s	e	t	p
0	0	0	0	003968	1	3	0	9	003968	2	3	3	18	007937
0	1	0	1	003968				10	007937	2	3	4	17	003968
			2	007937				11	011905				18	007937
			3	011905				12	007937				19	003968
			4	015873				13	003968	3	3	3	15	007937
			5	011905	1	3	1	11	007937				16	007937
			6	007937				12	015873				17	007937
			7	003968				13	015873				18	007937
0	1	0	4	003968				14	007937	3	3	4	17	007937
			5	007937	1	3	2	13	003968				18	007937
			6	019841				14	007937				19	007937
			7	023810				15	003968	3	3	5	19	007937
			8	023810	2	2	2	10	007937				20	007937
			9	015873				11	007937	3	3	6	21	003968
			10	003968				12	015873	3	4	0	16	003968
1	1	1	5	007937				13	007937	3	4	1	17	007937
			6	007937				14	007937	3	4	2	18	011705
			7	007937	2	2	3	13	007937	3	4	3	19	015873
			8	007937				14	007937	3	4	4	20	011905
1	1	2	9	003968				15	007937	3	4	5	21	007937
1	2	0	8	007937	2	2	4	16	003968	3	4	6	22	003968
			9	007937	2	3	0	12	007937	4	4	4	23	007937
			10	015873				13	007937	4	4	5	21	007937
			11	007937				14	007937	4	4	6	22	007937
			12	003968				15	003968	4	4	7	23	007937
1	2	1	7	007937	2	3	1	13	007937	4	4	8	24	003968
			8	015873				14	015873	5	5	10	25	003988
			9	031746				15	015873					
			10	031746				16	007937					
			11	031746	2	3	2	13	007937					
			12	015873				14	015873					
			13	007937				15	023810					
			10	003968				11	023810					
			11	007937				17	011705					
			12	011905	2	3	3	15	007937					
			13	007937				16	015873					
			14	003958				17	015873					

Table 3.2

For this it is easily seen that for $\alpha = .05$, the levels attained by the tests based on L^*, K^+, S, E, T are .047619, .039685, .003968 .041746, .043653 respectively, and that the level attained for L^* is higher than that of any other.

In [14], Vincze has considered a test based on the joint distribution K^+ and S^+ where

$$R^+ = \text{Min}\left(\frac{i}{n},\ F'_n(x) - F_n(x) \quad = K^+\right)$$

and $S^+ = R^+ - K^+$.

Let,

$$P_{ks} = P\left[nK^+ = k,\ nS^+ = s \middle| H_0\right]$$

$$Q_{ks} = P\left[nK^+ = k,\ n\ S^+ = s \middle| H_1\right].$$

The test suggested corresponds to the region in the (k, s) plane, say $K(\alpha)$ where,

$$K_\alpha = \left\{ (k,\ s):\ \frac{Q_{ks}}{P_{ks}} > C_\alpha \right\}$$

C_α being the smallest number for which

$$\sum_{(k,\ s) \in K_\alpha} P_{ks} \leq \alpha.$$

Vincze discusses this test for a specified alternative, where he assumes the distribution F(x) and F'(x) under the alternative, and computes the power of the test. We may also construct a test based on several statistics similar to that of Vincze and compute the power of the test where the alternative is specified.

Hitherto our discussion was limited to tests, where the statistic, under the alternative induces a complete ordering on the sample space. However, we observe from (3.1) that (K, R) induces a partial ordering on the sample space. In general it may be noted that the consideration of several statistics simultaneously leads to a partial ordering. For example, the relations,

(3.5)

$$P\left[nK^{+} = k_1, S = s, E = e, T = t \mid H_2\right] > P\left[nK^{+} = k_2, S = s, E = e, T = t \mid H_2\right] \text{ for } k_1 > k_2$$

$$P\left[nK^{+} = k, S = s_1, E = e, T = t \mid H_2\right] > P\left[nK^{+} = k, S = s_2, E = e, T = t \mid H_2\right] \text{ for } s_1 > s_2$$

$$P\left[nK^{+} = k, S = s, E = e_1, T = t \mid H_2\right] > P\left[nK^{+} = k, S = s, E = e_2, T = t \mid H_2\right] \text{ for } e_1 > e_2$$

$$P\left[nK^{+} = k, S = s, E = e, T = t_1 \mid H_2\right] > P\left[nK^{+} = k, S = s, E = e, T = t_2 \mid H_2\right] \text{ for } t_1 > t_2$$

divide the sample space into sets which are partially ordered.

In such situations following Switzer [11], we are able to give significance probability bounds for any observation on the basis of the joint distribution of several statistics under H_0. To illustrate this let us again consider (K, R).

In the following discussion, we say (k, r) dominates (k', r') if

$$P[nK = k,\ R = r | H_1] \geqslant P[nK = k',\ R = r' | H_1].$$

Let (k, r) be observed. Obviously if the rejection region, say $\emptyset$ of an admissible test contains (k, r) it must also contain all points (k', r') dominating (k, r).

Therefore

$$P[\emptyset | H_0] \geqslant L(k,\ r),$$

where L(k, r) is the probability under H_0 of all points (k', r') dominating (k, r), the expression for which is given by

$$L(k,\ r) = \sum_{r'=2}^{r} \sum_{k'=k}^{n} P[nK = k',\ R = r' | H_0].$$

In other words when (k, r) is observed, no admissible test can reject H_0 at levels less than L(k, r). Alternatively, if any admissible test has size less than L(k, r), then H_0 is accepted when (k, r) is observed. It is easily seen that in the example given in Table 3.1,

$$L(4,\ 5) = .082250.$$

Therefore when (4, 5) is observed H_0 is accepted at level .05.

Similarly if (k, r) is in the acceptance region $\bar{\Theta}$ of an admissible test, then all points dominated by (k, r) must also be in the acceptance region.

Therefore

$$P[\bar{\Theta} | H_0] \geq \bar{U}(k, r), \text{ where}$$

$$\bar{U}(k, r) = \sum_{r'=r}^{2n} \sum_{k'=0}^{k} P[nK = k', R = r' | H_0].$$

Hence, if Θ is the rejection region,

$$P[\Theta | H_0] \leq 1 - \bar{U}(k, r) = U(k, r) \text{ say.}$$

This means that, when (k, r) is observed, any admissible test of size greater than $U(k, r)$ will reject H_0.

For example, from Table 3.1 $U(4, 4) = .032454$. Hence H_0 is rejected, against H_1 at level .05, when (4, 4) is observed. Recall that if (4, 4) is observed the test based on L rejects H_0, against an alternative which is a subset of H_1.

Combining both we may say that if for some (k, r)

$$U(k, r) \geq \alpha \geq L(k, r), \text{ where}$$

α is the level of significance, then we neither accept nor reject H_0. For example

$$L(3, 3) = .011984 \text{ and}$$

$$(3, 3) = .142836.$$

Thus at level $\alpha = .05$, a decision to accept H_0 or not to, based on the joint distribution of (K, R) for n = 6 is not possible, when (3, 3) is observed. Interesting enough to note that the run test rejects H_0 under the same situation.

A general treatment is similar, for which one needs only the joint distribution of various statistics under H_0, which was dealt in Chapter 2.

APPENDIX A

```
C     COMPUTER PROGRAM TO TABULATE
C     THE JOINT DISTRIBUTION OF (K+,S,E,T) AND
C     THE DISTRIBUTION OF L*

      DIMENSION L(6195),LA(28371),MIN(20,20),MAX(20,20),MINSE(21,41)
      DIMENSION TEST(484)
      NI=20
      NT=0
      DO 10 IX=1,NI
      MAXS=NI+1-IX
      DO 10 IS=1,MAXS
      ISR=IS-1
      NT=NT+1
      MIN(IX,IS)=NT
      NT=NT+(IX-1)*(NI-(IX+ISR))
      MAX(IX,IS)=NT
   10 CONTINUE
      NIA=21
      NT=0
      DO 20 IS=1,NIA
      MAXE=2*IS-1
      DO 20 IE=1,MAXE
      NT=NT+1
      MINSE(IS,IE)=NT
      NT=NT+2*(IS-1)*(NIA-IS)-(NIA-IS)*(IE-1)
```

```
   20 CONTINUE
      LTEST=0
C     INITIALISATION FOR N
      DO 5000 N=2,NI
      NA=N-1
      NB=N+1
      DO 12 I=1,28371
   12 LA(I)=0
      TPROB=0
      PT=1.0
      DO 13 I=1,N
   13 PT=(PT*(N+I))/I
      DO 14 I=1,484
   14 TEST(I)=0.0
      CTEST=0.0
      WRITE(6,1010)N,PT
 1010 FORMAT(I22,F20.0)
C     INITIALISATION FOR K INCLUDING SETTING UP OF BOUNDARY VALUES
      DO 4000 K=1,NB
      KA=K-1
      IYMAX=(N+KA)/2
      IF(IYMAX.GT.NA) IYMAX=NA
      DO 1020 I=1,6195
 1020 L(I)=0
      DO 1040 IX=1,NA
      ISM=1
      IF(K.GT.1) ISM=ISM+1
```

```
      DO 1040 IS=1,ISM
      MINT=(IS-1)*IX+1
      MAXT=(IX-1)+(IS-1)+1
      DO 1040 IT=MINT,MAXT
      MOD=MIN(IX,IS)
      MOD=MOD+IT-MINT
      L(MOD)=1
 1040 CONTINUE
      IF(IYMAX.EQ.1) GO TO 2001
C     COMPUTATION OF VALUES ALONG THE MEDIAN DIAGONAL
      DO 2000 IY=2,IYMAX
      IYA=IY+1
      IXMAX=N-IY
      IF(IY.GT.K) GO TO 1080
      IF(IY.EQ.K) GO TO 1070
      MOD=MIN(1,IYA)
      L(MOD)=1
 1070 IF(IXMAX.EQ.1) GO TO 2000
      IXMIN=2
      GO TO 1090
 1080 IXMIN=IY-K
      IMIN=MIN(1,1)
      IMAX=MAX(IXMIN,NI)
      DO 1085 I=IMIN,IMAX
 1085 L(I)=0
      IXMIN=IXMIN+1
 1090 DO 2000 IX=IXMIN,IXMAX
```

```
      DO 2000 IS=1,IYA
      ISR=IS-1
      MINT=ISR*IX+1
      MINTA=ISR*(IX-1)+1
      MAXT=ISR*IX+(IY-ISR)*(IX-1)+1
      DO 2000 IT=MINT,MAXT
      MOD=MIN(IX,IS)
      MODA=MIN(IX-1,IS)
      MOD=MOD+IT-MINT
      IF((MINTA+IY).GT.IT) GO TO 2000
      MODA=MODA+IT-(MINTA+IY)
      L(MOD)=L(MOD)+L(MODA)
 2000 CONTINUE
C     COMPUTATION OF VALUES AT (N,N) AND
C     PRINTING FOR EACH K,S,E AND T.
 2001 MMA=IYMAX+2
      MINS=1
      IF(K.GT.2) MINS=K-1
      DO 4000 NS=MINS,MMA
      NSR=NS-1
      IF(NS.GT.1) GO TO 2500
      NTA=0
      NEA=0
      LP=1
      GO TO 3400
 2500 IF(NS.LT.MMA) GO TO 3300
      IF(K.LE.N) GO TO 3500
```

```
      NTA=N*N
      NEA=2*N
      LP=1
      GO TO 3400
3300  MINT=NSR*NSR
      MAXE=2*NSR+1
      DO 3350 NE=1,MAXE
      NEA=NE-1
3307  MINTA=MINT+(N-NSR)*(NE-1)
      MAXT=2*NSR*(N-NSR)+MINT-(2*NSR-(NE-1))
      DO 3350 NT=MINTA,MAXT
      LP=0
      MAXI=NS
      IF(NE.LT.NS) MAXI=NE
      IF(K.LT.MAXI) MAXI=K
      DO 3310 I=1,MAXI
      IX=N-NSR
      IS=I
      MINJ=IX*(IS-1)+1
      MAXJ=(IX-1)*(NS-IS)+MINJ
      DO 3310 J=MINJ,MAXJ
      IS=I
      MOD=MIN(IX,IS)+J-MINJ
      IS=NE+1-I
      IF(IS.GT.MAXI) GO TO 3310
      JA=(NT-MINT)+1-(J-1)
      MINJA=IX*(IS-1)+1
```

```
      MAXJA=(IX-1)*(NS-IS)+MINJA
      IF(JA.LT.MINJA) GO TO 3310
      IF(JA.GT.MAXJA) GO TO 3310
      MODA=MIN(IX,IS)+JA-MINJA
      LP=LP+L(MOD)*L(MODA)
 3310 CONTINUE
      IF(LP.LT.1) GO TO 3350
      NTA=NT
      NEA=NE-1
      LTEST=1
      GO TO 3400
 3340 LTEST=0
 3350 CONTINUE
      GO TO 4000
 3400 NEB=NEA+1
      NTB=NTA+1
      MOD=MINSE(NS,NEB)+NTB-((N-NSR)*NEA+1+NSR*NSR)
      LPEK=LP-LA(MOD)
      LA(MOD)=LP
      IF(LPEK.LT.1) GO TO 3420
      PROB=LPEK/PT
      TPROB=TPROB+PROB
      KK=N-KA
      KS=N-NSR
      KE=2*N-NEA
      KT=N*N-NTA
      MODT=KK+KS+KE+KT+1
```

```
      TEST(MODT)=TEST(MODT)+PROB
      IF(PROB.LT.0.0000005) GO TO 3420
      WRITE(6,3410)N,KA,NSR,NEA,NTA,LPEK,PROB,TPROB
 3410 FORMAT(6I10,2F20.6)
 3420 IF(LTEST.EQ.1) GO TO 3340
 4000 CONTINUE
      KD=1
C     PRINTING FOR EACH N AND L*
      DO 5000 I=1,484
      IF(TEST(I).EQ.0.0) GO TO 5000
      IA=I-1
      KA=N-IA
      IF(N.LT.IA) KA=0
      NSR=N-IA
      IF(N.LT.IA) NSR=0
      NEB=2*N-IA
      IF(2*N.LT.IA) NEB=0
      NTB=N*N-IA
      IF(N*N.LT.IA) NTB=0
      CTEST=CTEST+TEST(I)
      WRITE(6,4100)N,IA,KA,NSR,NEB,NTB,TEST(I),CTEST
 4100 FORMAT(2I10,I20,3I6,2F20.6)
 5000 CONTINUE
      STOP
      END
```

APPENDIX B

Table of $P\left(L^* = \ell^*\right) 10.^6 = p$, for n less than or equal 10.

ℓ^*	p	ℓ^*	p	ℓ^*	p	ℓ^*	p	ℓ^*	p
n = 2		n = 5		10	001082	55	004329	45	034965
0	166667	0	003968	11	002165	56	003247	46	034674
5	166667	5	003968	12	003247	57	002165	47	036131
7	333333	7	007937	13	002165	58	001082	48	035839
10	166667	9	007937	14	005411	60	001082	49	036131
12	166667	10	003968	15	004329	n = 7		50	035548
n = 3		11	007937	16	006494	0	000291	51	034091
0	050000	12	011905	17	003247	5	000291	52	032343
5	050000	13	007937	18	011905	7	000583	53	029720
7	100000	14	019841	19	005411	9	000583	54	028555
9	100000	15	007937	20	012987	10	000291	55	026515
10	050000	16	023810	21	012987	11	000583	56	025641
12	150000	17	011905	22	014069	12	000874	57	023310
14	150000	18	035714	23	015152	13	000583	58	021853
15	100000	19	019841	24	020563	14	001457	59	018939
17	050000	20	031746	25	020563	15	001166	60	017774
18	100000	21	039683	26	020563	16	001748	61	014569
19	050000	22	035714	27	025974	17	001457	62	013403
21	050000	23	039683	28	028139	18	003205	63	011072
n = 4		24	043651	29	029221	19	001457	64	009324
0	014286	25	051587	30	033550	20	004079	65	008159
5	014286	26	039683	31	034632	21	003497	66	006410
7	028571	27	047619	32	040043	22	004953	67	005536
9	028571	28	055556	33	035714	23	004662	68	003497
10	014286	29	047619	34	041126	24	006702	69	002914
11	028571	30	051587	35	036797	25	006702	70	002331
12	042857	31	047619	36	042208	26	007867	71	001748
14	071429	32	055556	37	040043	27	009324	72	001166
15	028571	33	027778	38	042208	28	010490	73	000874
16	057143	34	039683	39	040043	29	011364	74	000583
17	042857	35	031746	40	040043	30	013403	75	000291
18	071429	36	031746	41	036797	31	014569	77	000291
19	042857	37	031746	42	036797	32	017191	n = 8	
20	057143	38	015873	43	035714	33	016900	0	000078
21	085714	39	015873	44	031385	34	020979	5	000078
22	057143	40	015873	45	031385	35	020396	7	000155
23	057143	41	011905	46	024892	36	023893	9	000155
24	042857	42	007937	47	023810	37	023601	10	000078
25	057143	43	003968	48	020563	38	027681	11	000153
26	028571	45	003968	49	017316	39	025932	12	000233
27	028571	n = 6		50	016234	40	030303	13	000155
28	042857	0	001082	51	012987	41	030012	14	000389
29	028571	5	001082	52	008658	42	031760	15	000311
30	014286	7	002165	53	006494	43	031469	16	000466
32	014286	9	002165	54	006494	44	033508	17	000389

ℓ^*	p	ℓ^*	p	ℓ^*	p	ℓ^*	p	ℓ^*	p
18	000855	69	021212	29	001049	80	020897	19	000038
19	000544	70	019658	30	001357	81	019848	20	000076
20	001088	71	018026	31	001440	82	018840	21	000076
21	000932	72	016472	32	001789	83	017770	22	000103
22	001476	73	014996	33	001892	84	016742	23	000097
23	001243	74	013442	34	002324	85	015487	24	000157
24	002098	75	011888	35	002427	86	014377	25	000135
25	001943	76	010334	36	003044	87	013184	26	000200
26	002409	77	009246	37	003209	88	012053	27	000206
27	002797	78	007770	38	003867	89	010860	28	000281
28	003419	79	006682	39	004011	90	009831	29	000287
29	003652	80	005672	40	004875	91	008782	30	000379
30	004507	81	004662	41	005060	92	007795	31	000401
31	004817	82	003963	42	005903	93	006870	32	000514
32	005828	83	003108	43	006211	94	005985	33	000541
33	006061	84	002642	44	007219	95	005162	34	000677
34	007537	85	002020	45	007589	96	004504	35	000714
35	007615	86	001476	46	008556	97	003784	36	000898
36	009324	87	001088	47	009111	98	003209	37	000953
37	009790	88	000932	48	010243	99	002694	38	001169
38	011422	89	000622	49	010983	100	002221	39	001229
39	011422	90	000466	50	012094	101	001851	40	001521
40	013753	91	000311	51	002999	102	001481	41	001602
41	014064	92	000233	52	014171	103	001213	42	001894
42	015618	93	000155	53	015117	104	000946	43	002024
43	016317	94	000078	54	016228	105	000782	44	002398
44	018182	96	000078	55	017153	106	000535	45	002555
45	018881	n = 9		56	018202	107	000432	46	002955
46	020513	0	000021	57	019128	108	000329	47	003199
47	021678	5	000021	58	020074	109	000247	48	003632
48	023232	7	000041	59	020876	110	000165	49	003951
49	024786	9	000041	60	021946	111	000123	50	004471
50	026185	10	000021	61	022460	112	000082	51	004850
51	027428	11	000041	62	023406	113	000062	52	005423
52	028361	12	000062	63	023715	114	000041	53	005889
53	029060	13	000041	64	024476	115	000021	54	000506
54	029526	14	000103	65	024681	117	000021	55	007053
55	029681	15	000082	66	025524	n = 10		56	007735
56	029837	16	000123	67	025668	0	000005	57	008352
57	029992	17	000103	68	026265	5	000005	58	009044
58	030303	18	000226	69	026532	7	000011	59	009716
59	030148	19	000144	70	026861	9	000011	60	010490
60	030303	20	000288	71	026841	10	000005	61	011150
61	029215	21	000288	72	026944	11	000011	62	011956
62	028904	22	000391	73	026553	12	000016	63	012611
63	027817	23	000329	74	026183	13	000011	64	013407
64	027350	24	000596	75	025463	14	000027	65	014062
65	026185	25	000514	76	024661	15	000022	66	014874
66	025330	26	000720	77	023817	16	000032	67	015518
67	024242	27	000782	78	022789	17	000027	68	016335
68	022455	28	000987	79	021822	18	000060	69	017044

ℓ^*	p	ℓ^*	p	ℓ^*	p	ℓ^*	p	ℓ^*	p
70	017905	84	023415	98	015523	112	004292	125	000352
71	018641	85	023258	99	014641	113	003751	127	000271
72	019512	86	023020	100	013715	114	003264	128	000206
73	020232	87	022689	101	012801	115	002820	129	000152
74	021022	88	022273	102	011886	116	002425	130	000124
75	021634	89	021840	103	010998	117	002073	131	000087
76	022202	90	021315	104	010100	118	001743	132	000065
77	022614	91	020779	105	009250	119	001472	133	000043
78	022917	92	020167	106	008411	120	001229	134	000032
79	023122	93	019539	107	007626	121	001007	135	000022
80	023296	94	018798	108	006863	122	000844	136	000016
81	023355	95	018067	109	006149	123	000671	137	000011
82	023420	96	017261	110	005483	124	000552	138	000005
83	023458	97	016389	111	004860	125	000433	140	000005

```
C      APPENDIX C

C      COMPUTER PROGRAM TO TABULATE
C      THE JOINT DISTRIBUTION OF (K,S,R)

       DIMENSION LL(21,21),LB(21,21),TEST(85),L(21,42),
      -INA(150),INB(150),INC(150),IND(150),PNA(150)
       MAX=132
       LTEST=0
       DO 1 I=1,150
       INA(I)=0
       INB(I)=0
       INC(I)=0
       IND(I)=0
       PNA(I)=0.0
     1 CONTINUE
       WRITE(6,2)
     2 FORMAT(1H1,23X,10HAPPENDIX D,/)
       WRITE(6,3)
     3 FORMAT(1H ,23X,57HTABLE - JOINT PROBABILITY P OF (K,S,R) FOR N LE
      -S THAN 21,/)
       WRITE(6,4)
     4 FORMAT(1H ,20X,3(21H    N NK  S  R     P     ),/)
       LC=1
C      INITIALISATION FOR N
       DO 5000 N=2,21
       NR=N-1
```

```
      NRA=2*NR
      PT=1.0
      DO 10 I=1,NR
   10 PT=(PT*(NR+I))/I
      DO 20 I=1,21
      DO 20 J=1,42
   20 L(I,J)=0
C     INITIALISATION FOR K AND SETTING UP BOUNDARY VALUES
      DO 5000 K=1,NR
      KA=K+1
      DO 100 I=1,21
      DO 100 J=1,21
      LL(I,J)=0
      LB(I,J)=0
  100 CONTINUE
      DO 200 I=2,KA
  200 LL(I,1)=1
      IYMAX=(NR+K)/2+1
C     COMPUTATION OF VALUES ALONG THE MEDIAN DIAGONAL
      DO 2000 IY=2,IYMAX
      IYR=IY-1
      IF(IYR.LE.K) GO TO 1020
      IXMIN=IYR-K
      DO 1010 I=1,IXMIN
      DO 1010 J=1,21
      LL(I,J)=0
      LB(I,J)=0
```

```
 1010 CONTINUE
      IXMIN=IXMIN+1
      GO TO 1030
 1020 LB(1,1)=1
      IXMIN=2
 1030 IXMAX=N-IYR
      IXK=K+IY
      IF(IXMAX.GT.IXK) IXMAX=IXK
C     COMPUTATION OF PATHS FOR EACH (K,S,R) AND
C     TABULATING THEM
      IF(IXMAX.EQ.1) GO TO 2001
      DO 2000 IX=IXMIN,IXMAX
      DO 1050 IR=2,NR
      LB(IX,IR)=LL(IX,IR-1)+LB(IX,IR)
 1050 CONTINUE
      DO 1055 IR=2,NR
 1055 LL(IX,IR)=LL(IX-1,IR)+LB(IX-1,IR-1)
      LL(IX,1)=0
 2000 CONTINUE
 2001 MINS=(NR-K)/2+1
      MAXS=NR/2+1
      DO 5000 IS=MINS,MAXS
      ISR=IS-1
      NI=N-ISR
      NB=N-IS
      NRB=4*NB+2
      IF(ISR.LT.NB) NRB=4*ISR+2
```

```
      IF(ISR.EQ.NB) NRB=4*ISR
      DO 5000 IR=2,NRB
      IRA=IR-1
      IF(IRA.GT.20) IRA=20
      LT=0
      DO 2020 I=1,IRA
      IA=IR-I
      IF(IA.GT.20) GO TO 2020
      LT=LT+LL(NI,I)*LL(NI,IR-I)
      LT=LT+LB(NI,I)*LB(NI,IR-I)
      LT=LT+LL(NI,I+1)*LB(NI,IR-I)
      LT=LT+LB(NI,I+1)*LL(NI,IR-I)
 2020 CONTINUE
      LTEK=LT-L(ISR,IR)
      IF(L(ISR,IR).EQ.0) LTEK=LT
      IF(LTEK.EQ.0) GO TO 5000
      L(ISR,IR)=LT
      PROB=LTEK/PT
      IF(PROB.LT..0000005) GO TO 5000
      IF(LC.LT.MAX+1) GO TO 2050
      IF(LTEST.EQ.1) GO TO 2030
      LTEST=1
      MAX=150
 2030 WRITE(6,2040)
 2040 FORMAT(1H1,20X,3(21H    N NK   S   R      P    ),/)
      LC=1
 2050 INA(LC)=NR
```

```
      INB(LC)=K
      INC(LC)=ISR
      IND(LC)=IR
      PNA(LC)=PROB
      IF(LC.LT.MAX) GO TO 2800
      M=MAX/3
      DO 2500 I=1,M
      WRITE(6,2060)INA(I),INB(I),INC(I),IND(I),PNA(I),INA(I+M),
     -INB(I+M),INC(I+M),IND(I+M),PNA(I+M),
     -INA(I+2*M),INB(I+2*M),INC(I+2*M),IND(I+2*M),PNA(I+2*M)
2060  FORMAT(1H,20X,3(I4,3I3,F8.6))
2500  CONTINUE
2800  LC=LC+1
5000  CONTINUE
      M=LC/3
      IF(LC.GT.3*M) M=M+1
      DO 5002 I=1,M
      WRITE(6,5001)INA(I),INB(I),INC(I),IND(I),PNA(I),INA(I+M),
     -INB(I+M),INC(I+M),IND(I+M),PNA(I+M),
     -INA(I+2*M),INB(I+2*M),INC(I+2*M),IND(I+2*M),PNA(I+2*M)
5001  FORMAT(1H,20X,3(I4,3I3,F8.6))
5002  CONTINUE
      STOP
      END
```

APPENDIX D

TABLE - JOINT PROBABILITY P OF (K,S,R) FOR N LESS THAN 21

N	NK	S	R	P
1	1	0	2	.500000
2	1	1	3	.333333
2	1	1	4	.333333
2	2	0	2	.166667
3	1	1	4	.050000
3	1	1	5	.100000
3	1	1	6	.050000
3	2	1	3	.100000
3	2	1	4	.150000
3	3	0	2	.050000
4	1	2	5	.028571
4	1	2	6	.085714
4	1	2	7	.085714
4	1	2	8	.028571
4	2	1	4	.014286
4	2	1	5	.057143
4	2	1	6	.057143
4	2	2	3	.028571
4	2	2	4	.085714
4	2	2	5	.114286
4	2	2	6	.057143
4	3	1	3	.028571
4	3	1	4	.071429
4	4	0	2	.014286
5	1	2	6	.003968
5	1	2	7	.015873
5	1	2	8	.023810
5	1	2	9	.015873
5	1	2	10	.003968
5	2	2	4	.011905
5	2	2	5	.047619
5	2	2	6	.079365
5	2	2	7	.079365
5	2	2	8	.039683
5	3	1	4	.003968
5	3	1	5	.023810
5	3	1	6	.035714
5	3	2	3	.007937
5	3	2	4	.019841
5	3	2	5	.023810
5	3	2	6	.023810
5	4	1	3	.007937
5	4	1	4	.027778
5	5	0	2	.003968
6	1	3	7	.002165
6	1	3	8	.010823
6	1	3	9	.021645
6	1	3	10	.021645
6	1	3	11	.010823
6	1	3	12	.002165
6	2	2	4	.001082
6	2	2	5	.004329
6	2	2	6	.010823
6	2	2	7	.019481
6	2	2	8	.022727
6	2	2	9	.019481
6	2	2	10	.009740
6	2	3	5	.008658
6	2	3	6	.043290
6	2	3	7	.084416
6	2	3	8	.084416
6	2	3	9	.047619
6	2	3	10	.012987
6	3	2	4	.002165
6	3	2	5	.015152
6	3	2	6	.032468
6	3	2	7	.038961
6	3	2	8	.035714
6	3	3	3	.002165
6	3	3	4	.010823
6	3	3	5	.025974
6	3	3	6	.025974
6	3	3	7	.012987
6	3	3	8	.004329
6	4	1	4	.001082
6	4	1	5	.008658
6	4	1	6	.017316
6	4	2	3	.002165
6	4	2	4	.007576
6	4	2	5	.008658
6	4	2	6	.012987
6	5	1	3	.002165
6	5	1	4	.009740
6	6	0	2	.001082
7	1	3	8	.000291
7	1	3	9	.001748
7	1	3	10	.004371
7	1	3	11	.005828
7	1	3	12	.004371
7	1	3	13	.001748
7	1	3	14	.000291
7	2	3	5	.001166
7	2	3	6	.007284
7	2	3	7	.022145
7	2	3	8	.042832
7	2	3	9	.053030
7	2	3	10	.040793
7	2	3	11	.020396
7	2	3	12	.006119
7	3	2	4	.000291
7	3	2	5	.001748
7	3	2	6	.004953
7	3	2	7	.010490
7	3	2	8	.015152
7	3	2	9	.013986
7	3	2	10	.010490
7	3	3	4	.001457
7	3	3	5	.007576
7	3	3	6	.019231
7	3	3	7	.033800
7	3	3	8	.033800
7	3	3	9	.018648
7	3	3	10	.009907
7	4	2	4	.000583
7	4	2	5	.005245
7	4	2	6	.013986
7	4	2	7	.017483
7	4	2	8	.022145
7	4	3	3	.000583
7	4	3	4	.002040
7	4	3	5	.004662
7	4	3	6	.006993
7	4	3	7	.003497
7	4	3	8	.002331
7	5	1	4	.000291
7	5	1	5	.002914
7	5	1	6	.007284
7	5	2	3	.000583
7	5	2	4	.002622
7	5	2	5	.002914
7	5	2	6	.005828
7	6	1	3	.000583

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
7	6	1	4	.003205	8	4	2	8	.008159	9	2	4	8	.003970
7	7	0	2	.000291	8	4	2	9	.007770	9	2	4	9	.011107
8	1	4	9	.000155	8	4	2	10	.007770	9	2	4	10	.021164
8	1	4	10	.001088	8	4	3	4	.000155	9	2	4	11	.028630
8	1	4	11	.003263	8	4	3	5	.001709	9	2	4	12	.028507
8	1	4	12	.005439	8	4	3	6	.005594	9	2	4	13	.020732
8	1	4	13	.005439	8	4	3	7	.011966	9	2	4	14	.010366
8	1	4	14	.003263	8	4	3	8	.017949	9	2	4	15	.003455
8	1	4	15	.001088	8	4	3	9	.010256	9	2	4	16	.000740
8	1	4	16	.000155	8	4	3	10	.008392	9	3	3	4	.000021
8	2	3	6	.000311	8	4	4	3	.000155	9	3	3	5	.000123
8	2	3	7	.002176	8	4	4	4	.001088	9	3	3	6	.000555
8	2	3	8	.006294	8	4	4	5	.003730	9	3	3	7	.001728
8	2	3	9	.010567	8	4	4	6	.005594	9	3	3	8	.003928
8	2	3	10	.012743	8	4	4	7	.005594	9	3	3	9	.007199
8	2	3	11	.011810	8	4	4	8	.003730	9	3	3	10	.009564
8	2	3	12	.007770	8	4	4	9	.001243	9	3	3	11	.009872
8	2	3	13	.003730	8	4	4	10	.000311	9	3	3	12	.008227
8	2	3	14	.001243	8	5	2	4	.000155	9	3	3	13	.004114
8	2	4	5	.000155	8	5	2	5	.001709	9	3	3	14	.002057
8	2	4	6	.001399	8	5	2	6	.005439	9	3	4	5	.000247
8	2	4	7	.006527	8	5	2	7	.006993	9	3	4	6	.001892
8	2	4	8	.019270	8	5	2	8	.011267	9	3	4	7	.006993
8	2	4	9	.038539	8	5	3	3	.000155	9	3	4	8	.017009
8	2	4	10	.052836	8	5	3	4	.000699	9	3	4	9	.028383
8	2	4	11	.048174	8	5	3	5	.001554	9	3	4	10	.032703
8	2	4	12	.027972	8	5	3	6	.003108	9	3	4	11	.028383
8	2	4	13	.009946	8	5	3	7	.001554	9	3	4	12	.017688
8	2	4	14	.001865	8	5	3	8	.001554	9	3	4	13	.006253
8	3	3	4	.000233	8	6	1	4	.000078	9	3	4	14	.002262
8	3	3	5	.001399	8	6	1	5	.000932	9	4	3	4	.000041
8	3	3	6	.004973	8	6	1	6	.002797	9	4	3	5	.000370
8	3	3	7	.012277	8	6	2	3	.000155	9	4	3	6	.001481
8	3	3	8	.020824	8	6	2	4	.000855	9	4	3	7	.004607
8	3	3	9	.028904	8	6	2	5	.000932	9	4	3	8	.009770
8	3	3	10	.028594	8	6	2	6	.002331	9	4	3	9	.014603
8	3	3	11	.016162	8	7	1	3	.000155	9	4	3	10	.018511
8	3	3	12	.009013	8	7	1	4	.001010	9	4	3	11	.010695
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9	5	3	6	.002057	10	2	4	12	.007226	10	4	3	11	.006279
9	5	3	7	.004566	10	2	4	13	.007307	10	4	3	12	.006414
9	5	3	8	.008515	10	2	4	14	.005683	10	4	3	13	.003248
9	5	3	9	.004936	10	2	4	15	.003518	10	4	3	14	.002165
9	5	3	10	.005348	10	2	4	16	.001624	10	4	4	4	.000027
9	5	4	3	.000041	10	2	4	17	.000541	10	4	4	5	.000184
9	5	4	4	.000185	10	2	4	18	.000135	10	4	4	6	.000801
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9	8	1	4	.000309	10	3	5	6	.000433	10	5	3	11	.005900
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10	5	5	5	.000433	10	10	0	2	.000005	11	3	5	16	.005378
10	5	5	6	.000866	11	1	5	12	.000001	11	3	5	17	.001395
10	5	5	7	.001299	11	1	5	13	.000014	11	3	5	18	.000383
10	5	5	8	.001299	11	1	5	14	.000064	11	4	4	4	.000004
10	5	5	9	.000866	11	1	5	15	.000170	11	4	4	5	.000034
10	5	5	10	.000433	11	1	5	16	.000298	11	4	4	6	.000184
10	5	5	11	.000108	11	1	5	17	.000357	11	4	4	7	.000678
10	5	5	12	.000022	11	1	5	18	.000298	11	4	4	8	.001877
10	6	2	4	.000005	11	1	5	19	.000170	11	4	4	9	.004474
10	6	2	5	.000065	11	1	5	20	.000064	11	4	4	10	.008040
10	6	2	6	.000271	11	1	5	21	.000014	11	4	4	11	.011698
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11	5	5	4	.000013	11	7	3	8	.001437	12	2	5	14	.003665
11	5	5	5	.000094	11	7	3	9	.000853	12	2	5	15	.004199
11	5	5	6	.000369	11	7	3	10	.001369	12	2	5	16	.003830
11	5	5	7	.001117	11	7	4	3	.000003	12	2	5	17	.002757
11	5	5	8	.002092	11	7	4	4	.000018	12	2	5	18	.001579
11	5	5	9	.002949	11	7	4	5	.000060	12	2	5	19	.000732
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N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
12	7	5	3	.000001	13	1	6	15	.000001	13	3	6	12	.010141
12	7	5	4	.000005	13	1	6	16	.000006	13	3	6	13	.016411
12	7	5	5	.000021	13	1	6	17	.000021	13	3	6	14	.021490
12	7	5	6	.000062	13	1	6	18	.000048	13	3	6	15	.022875
12	7	5	7	.000093	13	1	6	19	.000076	13	3	6	16	.019711
12	7	5	8	.000155	13	1	6	20	.000089	13	3	6	17	.013815
12	7	5	9	.000104	13	1	6	21	.000076	13	3	6	18	.007736
12	7	5	10	.000104	13	1	6	22	.000048	13	3	6	19	.003350
12	7	5	11	.000026	13	1	6	23	.000021	13	3	6	20	.001191
12	7	5	12	.000016	13	1	6	24	.000006	13	3	6	21	.000244
12	8	2	5	.000006	13	1	6	25	.000001	13	3	6	22	.000054
12	8	2	6	.000030	13	2	6	8	.000001	13	4	5	5	.000001
12	8	2	7	.000080	13	2	6	9	.000010	13	4	5	6	.000009
12	8	2	8	.000243	13	2	6	10	.000073	13	4	5	7	.000060
12	8	2	9	.000240	13	2	6	11	.000337	13	4	5	8	.000269
12	8	2	10	.000479	13	2	6	12	.001097	13	4	5	9	.000845
12	8	3	4	.000001	13	2	6	13	.002676	13	4	5	10	.002077
12	8	3	5	.000014	13	2	6	14	.005076	13	4	5	11	.004215
12	8	3	6	.000077	13	2	6	15	.007645	13	4	5	12	.006902
12	8	3	7	.000184	13	2	6	16	.009253	13	4	5	13	.009715
12	8	3	8	.000538	13	2	6	17	.009074	13	4	5	14	.011497
12	8	3	9	.000322	13	2	6	18	.007218	13	4	5	15	.010840
12	8	3	10	.000601	13	2	6	19	.004620	13	4	5	16	.009399
12	8	4	3	.000001	13	2	6	20	.002351	13	4	5	17	.005442
12	8	4	4	.000006	13	2	6	21	.000935	13	4	5	18	.003392
12	8	4	5	.000018	13	2	6	22	.000275	13	4	5	19	.000933
12	8	4	6	.000062	13	2	6	23	.000055	13	4	5	20	.000400
12	8	4	7	.000062	13	2	6	24	.000007	13	4	6	5	.000001
12	8	4	8	.000124	13	3	5	7	.000005	13	4	6	6	.000014
12	8	4	9	.000041	13	3	5	8	.000030	13	4	6	7	.000099
12	8	4	10	.000052	13	3	5	9	.000135	13	4	6	8	.000450
12	9	2	4	.000001	13	3	5	10	.000444	13	4	6	9	.001486
12	9	2	5	.000014	13	3	5	11	.001128	13	4	6	10	.003766
12	9	2	6	.000073	13	3	5	12	.002256	13	4	6	11	.007415
12	9	2	7	.000100	13	3	5	13	.003591	13	4	6	12	.011496
12	9	2	8	.000296	13	3	5	14	.004706	13	4	6	13	.014450
12	9	3	3	.000001	13	3	5	15	.005193	13	4	6	14	.014402
12	9	3	4	.000006	13	3	5	16	.004735	13	4	6	15	.011489
12	9	3	5	.000013	13	3	5	17	.003647	13	4	6	16	.007636
12	9	3	6	.000053	13	3	5	18	.002370	13	4	6	17	.003495
12	9	3	7	.000027	13	3	5	19	.001187	13	4	6	18	.001558
12	9	3	8	.000062	13	3	5	20	.000542	13	4	6	19	.000305
12	10	1	5	.000007	13	3	5	21	.000141	13	4	6	20	.000081
12	10	1	6	.000037	13	3	5	22	.000042	13	5	4	5	.000001
12	10	2	3	.000001	13	3	6	6	.000001	13	5	4	6	.000006
12	10	2	4	.000007	13	3	6	7	.000016	13	5	4	7	.000032
12	10	2	5	.000007	13	3	6	8	.000117	13	5	4	8	.000115
12	10	2	6	.000033	13	3	6	9	.000567	13	5	4	9	.000342
12	11	1	3	.000001	13	3	6	10	.001934	13	5	4	10	.000798
12	11	1	4	.000008	13	3	6	11	.005000	13	5	4	11	.001510

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13	5	4	12	.002464	13	6	5	8	.000348	13	7	5	13	.000152
13	5	4	13	.002975	13	6	5	9	.000871	13	7	5	14	.000112
13	5	4	14	.003511	13	6	5	10	.001895	13	7	6	4	.000001
13	5	4	15	.002531	13	6	5	11	.002545	13	7	6	5	.000007
13	5	4	16	.002186	13	6	5	12	.003706	13	7	6	6	.000020
13	5	4	17	.000754	13	6	5	13	.002497	13	7	6	7	.000040
13	5	4	18	.000471	13	6	5	14	.002459	13	7	6	8	.000067
13	5	5	5	.000004	13	6	5	15	.000646	13	7	6	9	.000067
13	5	5	6	.000025	13	6	5	16	.000424	13	7	6	10	.000067
13	5	5	7	.000109	13	6	6	4	.000001	13	7	6	11	.000034
13	5	5	8	.000357	13	6	6	5	.000009	13	7	6	12	.000020
13	5	5	9	.001043	13	6	6	6	.000040	13	7	6	13	.000004
13	5	5	10	.002345	13	6	6	7	.000146	13	7	6	14	.000001
13	5	5	11	.004327	13	6	6	8	.000334	13	8	3	5	.000003
13	5	5	12	.006935	13	6	6	9	.000606	13	8	3	6	.000019
13	5	5	13	.007846	13	6	6	10	.000875	13	8	3	7	.000070
13	5	5	14	.008994	13	6	6	11	.000841	13	8	3	8	.000241
13	5	5	15	.005746	13	6	6	12	.000767	13	8	3	9	.000392
13	5	5	16	.004664	13	6	6	13	.000381	13	8	3	10	.000893
13	5	5	17	.001276	13	6	6	14	.000214	13	8	3	11	.000535
13	5	5	18	.000716	13	6	6	15	.000043	13	8	3	12	.000851
13	5	6	5	.000003	13	6	6	16	.000014	13	8	4	5	.000004
13	5	6	6	.000031	13	7	3	5	.000001	13	8	4	6	.000025
13	5	6	7	.000161	13	7	3	6	.000008	13	8	4	7	.000080
13	5	6	8	.000569	13	7	3	7	.000035	13	8	4	8	.000251
13	5	6	9	.001466	13	7	3	8	.000120	13	8	4	9	.000278
13	5	6	10	.002739	13	7	3	9	.000271	13	8	4	10	.000544
13	5	6	11	.004151	13	7	3	10	.000612	13	8	4	11	.000197
13	5	6	12	.004923	13	7	3	11	.000711	13	8	4	12	.000256
13	5	6	13	.004368	13	7	3	12	.001142	13	8	5	4	.000001
13	5	6	14	.003489	13	7	3	13	.000582	13	8	5	5	.000006
13	5	6	15	.001662	13	7	3	14	.000678	13	8	5	6	.000022
13	5	6	16	.000849	13	7	4	5	.000003	13	8	5	7	.000032
13	5	6	17	.000170	13	7	4	6	.000020	13	8	5	8	.000065
13	5	6	18	.000050	13	7	4	7	.000090	13	8	5	9	.000043
13	6	4	5	.000002	13	7	4	8	.000311	13	8	5	10	.000054
13	6	4	6	.000016	13	7	4	9	.000656	13	8	5	11	.000013
13	6	4	7	.000078	13	7	4	10	.001491	13	8	5	12	.000011
13	6	4	8	.000275	13	7	4	11	.001523	13	9	2	5	.000002
13	6	4	9	.000746	13	7	4	12	.002371	13	9	2	6	.000010
13	6	4	10	.001729	13	7	4	13	.000910	13	9	2	7	.000026
13	6	4	11	.002694	13	7	4	14	.000993	13	9	2	8	.000087
13	6	4	12	.004386	13	7	5	5	.000004	13	9	2	9	.000087
13	6	4	13	.003804	13	7	5	6	.000024	13	9	2	10	.000195
13	6	4	14	.004466	13	7	5	7	.000095	13	9	3	5	.000004
13	6	4	15	.001691	13	7	5	8	.000278	13	9	3	6	.000024
13	6	4	16	.001432	13	7	5	9	.000428	13	9	3	7	.000059
13	6	5	5	.000003	13	7	5	10	.000756	13	9	3	8	.000193
13	6	5	6	.000020	13	7	5	11	.000518	13	9	3	9	.000117
13	6	5	7	.000103	13	7	5	12	.000586	13	9	3	10	.000247

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
13	9	4	4	.000002	14	2	6	26	.000001	14	3	7	20	.004179
13	9	4	5	.000005	14	2	7	9	.000001	14	3	7	21	.001481
13	9	4	6	.000021	14	2	7	10	.000011	14	3	7	22	.000388
13	9	4	7	.000021	14	2	7	11	.000071	14	3	7	23	.000060
13	9	4	8	.000048	14	2	7	12	.000310	14	3	7	24	.000007
13	9	4	9	.000016	14	2	7	13	.000980	14	4	5	7	.000005
13	9	4	10	.000024	14	2	7	14	.002384	14	4	5	8	.000030
13	10	2	5	.000004	14	2	7	15	.004591	14	4	5	9	.000110
13	10	2	6	.000023	14	2	7	16	.007126	14	4	5	10	.000323
13	10	2	7	.000032	14	2	7	17	.009007	14	4	5	11	.000763
13	10	2	8	.000105	14	2	7	18	.009331	14	4	5	12	.001475
13	10	3	4	.000002	14	2	7	19	.007950	14	4	5	13	.002448
13	10	3	5	.000004	14	2	7	20	.005562	14	4	5	14	.003396
13	10	3	6	.000017	14	2	7	21	.003164	14	4	5	15	.004004
13	10	3	7	.000009	14	2	7	22	.001436	14	4	5	16	.004112
13	10	3	8	.000023	14	2	7	23	.000504	14	4	5	17	.003350
13	11	1	5	.000002	14	2	7	24	.000129	14	4	5	18	.002560
13	11	1	6	.000012	14	2	7	25	.000022	14	4	5	19	.001329
13	11	2	4	.000002	14	2	7	26	.000002	14	4	5	20	.000748
13	11	2	5	.000002	14	3	6	7	.000002	14	4	5	21	.000195
13	11	2	6	.000011	14	3	6	8	.000017	14	4	5	22	.000078
13	12	1	4	.000002	14	3	6	9	.000094	14	4	6	6	.000002
14	1	7	16	.000001	14	3	6	10	.000382	14	4	6	7	.000020
14	1	7	17	.000004	14	3	6	11	.001191	14	4	6	8	.000111
14	1	7	18	.000014	14	3	6	12	.002900	14	4	6	9	.000436
14	1	7	19	.000036	14	3	6	13	.005666	14	4	6	10	.001310
14	1	7	20	.000064	14	3	6	14	.009071	14	4	6	11	.003083
14	1	7	21	.000086	14	3	6	15	.011991	14	4	6	12	.005880
14	1	7	22	.000086	14	3	6	16	.013210	14	4	6	13	.009338
14	1	7	23	.000064	14	3	6	17	.012252	14	4	6	14	.012196
14	1	7	24	.000036	14	3	6	18	.009462	14	4	6	15	.013571
14	1	7	25	.000014	14	3	6	19	.006140	14	4	6	16	.012858
14	1	7	26	.000004	14	3	6	20	.003364	14	4	6	17	.009733
14	1	7	27	.000001	14	3	6	21	.001434	14	4	6	18	.006855
14	2	6	10	.000004	14	3	6	22	.000555	14	4	6	19	.003170
14	2	6	11	.000024	14	3	6	23	.000120	14	4	6	20	.001614
14	2	6	12	.000097	14	3	6	24	.000031	14	4	6	21	.000342
14	2	6	13	.000294	14	3	7	7	.000002	14	4	6	22	.000117
14	2	6	14	.000684	14	3	7	8	.000023	14	4	7	6	.000003
14	2	6	15	.001259	14	3	7	9	.000150	14	4	7	7	.000026
14	2	6	16	.001872	14	3	7	10	.000643	14	4	7	8	.000142
14	2	6	17	.002283	14	3	7	11	.002042	14	4	7	9	.000563
14	2	6	18	.002296	14	3	7	12	.005048	14	4	7	10	.001705
14	2	6	19	.001906	14	3	7	13	.009995	14	4	7	11	.004039
14	2	6	20	.001304	14	3	7	14	.016098	14	4	7	12	.007679
14	2	6	21	.000728	14	3	7	15	.021251	14	4	7	13	.011809
14	2	6	22	.000330	14	3	7	16	.023109	14	4	7	14	.014694
14	2	6	23	.000122	14	3	7	17	.020690	14	4	7	15	.014892
14	2	6	24	.000035	14	3	7	18	.015139	14	4	7	16	.012008
14	2	6	25	.000007	14	3	7	19	.008964	14	4	7	17	.007712

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
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14	4	7	19	.001410	14	5	7	19	.000033	14	6	7	12	.000872
14	4	7	20	.000409	14	5	7	20	.000004	14	6	7	13	.000639
14	4	7	21	.000066	14	6	4	6	.000002	14	6	7	14	.000371
14	4	7	22	.000008	14	6	4	7	.000011	14	6	7	15	.000147
14	5	5	5	.000001	14	6	4	8	.000044	14	6	7	16	.000047
14	5	5	6	.000005	14	6	4	9	.000137	14	6	7	17	.000008
14	5	5	7	.000026	14	6	4	10	.000351	14	6	7	18	.000001
14	5	5	8	.000100	14	6	4	11	.000690	14	7	4	5	.000001
14	5	5	9	.000332	14	6	4	12	.001255	14	7	4	6	.000005
14	5	5	10	.000857	14	6	4	13	.001556	14	7	4	7	.000026
14	5	5	11	.001904	14	6	4	14	.002086	14	7	4	8	.000100
14	5	5	12	.003530	14	6	4	15	.001526	14	7	4	9	.000281
14	5	5	13	.005264	14	6	4	16	.001533	14	7	4	10	.000719
14	5	5	14	.007171	14	6	4	17	.000528	14	7	4	11	.001144
14	5	5	15	.007000	14	6	4	18	.000396	14	7	4	12	.002090
14	5	5	16	.007088	14	6	5	5	.000001	14	7	4	13	.001834
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14	5	6	9	.000579	14	6	5	14	.005217	14	7	5	10	.000783
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14	5	6	20	.000130	14	6	6	11	.001468	14	7	6	9	.000202
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14	5	7	7	.000049	14	6	6	14	.002153	14	7	6	12	.000428
14	5	7	8	.000215	14	6	6	15	.001064	14	7	6	13	.000216
14	5	7	9	.000685	14	6	6	16	.000733	14	7	6	14	.000163
14	5	7	10	.001653	14	6	6	17	.000150	14	7	6	15	.000033
14	5	7	11	.003107	14	6	6	18	.000066	14	7	6	16	.000016
14	5	7	12	.004453	14	6	7	5	.000001	14	7	7	4	.000001
14	5	7	13	.005123	14	6	7	6	.000013	14	7	7	5	.000004
14	5	7	14	.004527	14	6	7	7	.000063	14	7	7	6	.000013
14	5	7	15	.003118	14	6	7	8	.000195	14	7	7	7	.000031
14	5	7	16	.001708	14	6	7	9	.000450	14	7	7	8	.000052
14	5	7	17	.000656	14	6	7	10	.000715	14	7	7	9	.000070

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
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14	7	7	11	.000052	14	9	3	11	.000212	15	1	7	18	.000001
14	7	7	12	.000031	14	9	3	12	.000380	15	1	7	19	.000002
14	7	7	13	.000013	14	9	4	5	.000001	15	1	7	20	.000006
14	7	7	14	.000004	14	9	4	6	.000008	15	1	7	21	.000013
14	7	7	15	.000001	14	9	4	7	.000025	15	1	7	22	.000019
14	8	3	6	.000003	14	9	4	8	.000089	15	1	7	23	.000022
14	8	3	7	.000012	14	9	4	9	.000099	15	1	7	24	.000019
14	8	3	8	.000043	14	9	4	10	.000220	15	1	7	25	.000013
14	8	3	9	.000100	14	9	4	11	.000080	15	1	7	26	.000006
14	8	3	10	.000250	14	9	4	12	.000121	15	1	7	27	.000002
14	8	3	11	.000293	14	9	5	5	.000002	15	1	7	28	.000001
14	8	3	12	.000529	14	9	5	6	.000007	15	2	7	10	.000001
14	8	3	13	.000269	14	9	5	7	.000011	15	2	7	11	.000008
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15	3	7	12	.001655	15	4	7	23	.000064	15	5	7	20	.000319
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15	3	7	14	.007560	15	5	5	6	.000001	15	5	7	22	.000013
15	3	7	15	.012056	15	5	5	7	.000003	15	6	5	6	.000001
15	3	7	16	.016063	15	5	5	8	.000014	15	6	5	7	.000008
15	3	7	17	.017943	15	5	5	9	.000051	15	6	5	8	.000034
15	3	7	18	.016827	15	5	5	10	.000149	15	6	5	9	.000124
15	3	7	19	.013257	15	5	5	11	.000373	15	6	5	10	.000356
15	3	7	20	.008695	15	5	5	12	.000771	15	6	5	11	.000828
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15	7	4	10	.000145	15	8	4	7	.000008	15	9	3	14	.000176
15	7	4	11	.000292	15	8	4	8	.000035	15	9	4	6	.000002
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15	7	4	13	.000743	15	8	4	10	.000284	15	9	4	8	.000038
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16	2	7	19	.001217
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16	2	8	17	.002251
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16	3	7	28	.000004
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16	3	8	23	.002617
16	3	8	24	.000992
16	3	8	25	.000289
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16	5	6	7	.000002	16	5	8	21	.000262	16	6	7	19	.000619
16	5	6	8	.000011	16	5	8	22	.000068	16	6	7	20	.000341
16	5	6	9	.000047	16	5	8	23	.000010	16	6	7	21	.000058
16	5	6	10	.000153	16	5	8	24	.000001	16	6	7	22	.000021
16	5	6	11	.000420	16	6	5	7	.000001	16	6	8	6	.000001
16	5	6	12	.000952	16	6	5	8	.000005	16	6	8	7	.000006
16	5	6	13	.001898	16	6	5	9	.000020	16	6	8	8	.000028
16	5	6	14	.003232	16	6	5	10	.000062	16	6	8	9	.000100
16	5	6	15	.004696	16	6	5	11	.000164	16	6	8	10	.000277
16	5	6	16	.006159	16	6	5	12	.000368	16	6	8	11	.000610
16	5	6	17	.006417	16	6	5	13	.000673	16	6	8	12	.001043
16	5	6	18	.006517	16	6	5	14	.001134	16	6	8	13	.001474
16	5	6	19	.004680	16	6	5	15	.001445	16	6	8	14	.001640
16	5	6	20	.003671	16	6	5	16	.001870	16	6	8	15	.001491
16	5	6	21	.001659	16	6	5	17	.001612	16	6	8	16	.001098
16	5	6	22	.000994	16	6	5	18	.001619	16	6	8	17	.000627
16	5	6	23	.000217	16	6	5	19	.000868	16	6	8	18	.000294
16	5	6	24	.000097	16	6	5	20	.000677	16	6	8	19	.000096
16	5	7	7	.000003	16	6	5	21	.000176	16	6	8	20	.000026
16	5	7	8	.000019	16	6	5	22	.000106	16	6	8	21	.000004
16	5	7	9	.000081	16	6	6	6	.000001	16	7	5	7	.000003
16	5	7	10	.000273	16	6	6	7	.000004	16	7	5	8	.000012
16	5	7	11	.000735	16	6	6	8	.000016	16	7	5	9	.000046

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16	7	5	11	.000340	16	7	8	16	.000053	16	8	7	14	.000088
16	7	5	12	.000763	16	7	8	17	.000018	16	8	7	15	.000036
16	7	5	13	.001201	16	7	8	18	.000005	16	8	7	16	.000023
16	7	5	14	.002030	16	7	8	19	.000001	16	8	7	17	.000004
16	7	5	15	.002062	16	8	4	7	.000001	16	8	7	18	.000002
16	7	5	16	.002677	16	8	4	8	.000006	16	8	8	6	.000001
16	7	5	17	.001620	16	8	4	9	.000019	16	8	8	7	.000004
16	7	5	18	.001627	16	8	4	10	.000057	16	8	8	8	.000008
16	7	5	19	.000453	16	8	4	11	.000117	16	8	8	9	.000013
16	7	5	20	.000350	16	8	4	12	.000258	16	8	8	10	.000016
16	7	6	6	.000001	16	8	4	13	.000331	16	8	8	11	.000016
16	7	6	7	.000003	16	8	4	14	.000552	16	8	8	12	.000013
16	7	6	8	.000016	16	8	4	15	.000411	16	8	8	13	.000008
16	7	6	9	.000059	16	8	4	16	.000528	16	8	8	14	.000004
16	7	6	10	.000180	16	8	4	17	.000181	16	8	8	15	.000001
16	7	6	11	.000409	16	8	4	18	.000181	16	9	4	7	.000003
16	7	6	12	.000890	16	8	5	6	.000001	16	9	4	8	.000012
16	7	6	13	.001274	16	8	5	7	.000003	16	9	4	9	.000035
16	7	6	14	.002044	16	8	5	8	.000014	16	9	4	10	.000107
16	7	6	15	.001813	16	8	5	9	.000048	16	9	4	11	.000175
16	7	6	16	.002166	16	8	5	10	.000150	16	9	4	12	.000391
16	7	6	17	.001080	16	8	5	11	.000298	16	9	4	13	.000348
16	7	6	18	.000956	16	8	5	12	.000665	16	9	4	14	.000585
16	7	6	19	.000203	16	8	5	13	.000793	16	9	4	15	.000223
16	7	6	20	.000131	16	8	5	14	.001322	16	9	4	16	.000287
16	7	7	6	.000001	16	8	5	15	.000879	16	9	5	6	.000001
16	7	7	7	.000006	16	8	5	16	.001109	16	9	5	7	.000003
16	7	7	8	.000019	16	8	5	17	.000313	16	9	5	8	.000015
16	7	7	9	.000061	16	8	5	18	.000300	16	9	5	9	.000039
16	7	7	10	.000152	16	8	6	6	.000001	16	9	5	10	.000115
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16	7	7	12	.000533	16	8	6	8	.000016	16	9	5	12	.000339
16	7	7	13	.000640	16	8	6	9	.000048	16	9	5	13	.000239
16	7	7	14	.000808	16	8	6	10	.000136	16	9	5	14	.000363
16	7	7	15	.000584	16	8	6	11	.000234	16	9	5	15	.000100
16	7	7	16	.000513	16	8	6	12	.000462	16	9	5	16	.000112
16	7	7	17	.000206	16	8	6	13	.000449	16	9	6	6	.000001
16	7	7	18	.000123	16	8	6	14	.000631	16	9	6	7	.000003
16	7	7	19	.000021	16	8	6	15	.000324	16	9	6	8	.000013
16	7	7	20	.000008	16	8	6	16	.000325	16	9	6	9	.000026
16	7	8	6	.000001	16	8	6	17	.000069	16	9	6	10	.000061
16	7	8	7	.000007	16	8	6	18	.000049	16	9	6	11	.000063
16	7	8	8	.000024	16	8	7	6	.000001	16	9	6	12	.000101
16	7	8	9	.000067	16	8	7	7	.000004	16	9	6	13	.000052
16	7	8	10	.000128	16	8	7	8	.000013	16	9	6	14	.000058
16	7	8	11	.000202	16	8	7	9	.000031	16	9	6	15	.000012
16	7	8	12	.000245	16	8	7	10	.000067	16	9	6	16	.000009
16	7	8	13	.000238	16	8	7	11	.000088	16	9	7	6	.000001
16	7	8	14	.000185	16	8	7	12	.000123	16	9	7	7	.000002

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16	9	7	8	.000004	16	11	4	7	.000002	17	2	8	21	.002944
16	9	7	9	.000006	16	11	4	8	.000010	17	2	8	22	.002853
16	9	7	10	.000008	16	11	4	9	.000011	17	2	8	23	.002358
16	9	7	11	.000006	16	11	4	10	.000031	17	2	8	24	.001661
16	9	7	12	.000006	16	11	4	11	.000012	17	2	8	25	.000992
16	9	7	13	.000003	16	11	4	12	.000023	17	2	8	26	.000499
16	9	7	14	.000002	16	11	5	6	.000001	17	2	8	27	.000209
16	10	3	7	.000001	16	11	5	7	.000001	17	2	8	28	.000072
16	10	3	8	.000005	16	11	5	8	.000003	17	2	8	29	.000020
16	10	3	9	.000012	16	11	5	9	.000002	17	2	8	30	.000004
16	10	3	10	.000036	16	11	5	10	.000004	17	2	8	31	.000001
16	10	3	11	.000043	16	11	5	11	.000001	17	3	7	10	.000002
16	10	3	12	.000095	16	11	5	12	.000002	17	3	7	11	.000009
16	10	3	13	.000048	16	12	2	7	.000001	17	3	7	12	.000036
16	10	3	14	.000081	16	12	2	8	.000003	17	3	7	13	.000113
16	10	4	6	.000001	16	12	2	9	.000003	17	3	7	14	.000290
16	10	4	7	.000003	16	12	2	10	.000010	17	3	7	15	.000622
16	10	4	8	.000013	16	12	3	6	.000001	17	3	7	16	.001129
16	10	4	9	.000028	16	12	3	7	.000002	17	3	7	17	.001752
16	10	4	10	.000084	16	12	3	8	.000007	17	3	7	18	.002343
16	10	4	11	.000088	16	12	3	9	.000005	17	3	7	19	.002707
16	10	4	12	.000193	16	12	3	10	.000013	17	3	7	20	.002712
16	10	4	13	.000076	16	12	4	6	.000001	17	3	7	21	.002365
16	10	4	14	.000122	16	12	4	7	.000001	17	3	7	22	.001788
16	10	5	6	.000001	16	12	4	8	.000002	17	3	7	23	.001180
16	10	5	7	.000003	16	12	4	9	.000001	17	3	7	24	.000676
16	10	5	8	.000012	16	12	4	10	.000002	17	3	7	25	.000328
16	10	5	9	.000019	16	13	2	6	.000001	17	3	7	26	.000142
16	10	5	10	.000049	16	13	2	7	.000001	17	3	7	27	.000047
16	10	5	11	.000035	16	13	2	8	.000004	17	3	7	28	.000015
16	10	5	12	.000062	16	13	3	6	.000001	17	3	7	29	.000003
16	10	5	13	.000017	16	13	3	8	.000001	17	3	7	30	.000001
16	10	5	14	.000021	17	1	8	22	.000001	17	3	8	9	.000001
16	10	6	6	.000001	17	1	8	23	.000002	17	3	8	10	.000007
16	10	6	7	.000001	17	1	8	24	.000003	17	3	8	11	.000037
16	10	6	8	.000004	17	1	8	25	.000005	17	3	8	12	.000153
16	10	6	9	.000004	17	1	8	26	.000006	17	3	8	13	.000504
16	10	6	10	.000007	17	1	8	27	.000005	17	3	8	14	.001346
16	10	6	11	.000003	17	1	8	28	.000003	17	3	8	15	.002977
16	10	6	12	.000004	17	1	8	29	.000002	17	3	8	16	.005533
16	10	6	13	.000001	17	1	8	30	.000001	17	3	8	17	.008725
16	10	6	14	.000001	17	2	8	12	.000001	17	3	8	18	.011754
16	11	3	6	.000001	17	2	8	13	.000006	17	3	8	19	.013579
16	11	3	7	.000002	17	2	8	14	.000028	17	3	8	20	.013488
16	11	3	8	.000010	17	2	8	15	.000100	17	3	8	21	.011518
16	11	3	9	.000016	17	2	8	16	.000282	17	3	8	22	.008429
16	11	3	10	.000048	17	2	8	17	.000645	17	3	8	23	.005273
16	11	3	11	.000029	17	2	8	18	.001221	17	3	8	24	.002795
16	11	3	12	.000064	17	2	8	19	.001935	17	3	8	25	.001239
16	11	4	6	.000001	17	2	8	20	.002589	17	3	8	26	.000460

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
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17	3	8	28	.000033	17	5	6	13	.000385	17	5	8	23	.000266
17	3	8	29	.000005	17	5	6	14	.000731	17	5	8	24	.000091
17	3	8	30	.000001	17	5	6	15	.001213	17	5	8	25	.000013
17	4	7	8	.000001	17	5	6	16	.001773	17	5	8	26	.000003
17	4	7	9	.000007	17	5	6	17	.002200	17	6	6	7	.000001
17	4	7	10	.000032	17	5	6	18	.002514	17	6	6	8	.000004
17	4	7	11	.000119	17	5	6	19	.002298	17	6	6	9	.000017
17	4	7	12	.000359	17	5	6	20	.002066	17	6	6	10	.000058
17	4	7	13	.000892	17	5	6	21	.001336	17	6	6	11	.000170
17	4	7	14	.001869	17	5	6	22	.000943	17	6	6	12	.000420
17	4	7	15	.003334	17	5	6	23	.000394	17	6	6	13	.000883
17	4	7	16	.005115	17	5	6	24	.000216	17	6	6	14	.001658
17	4	7	17	.006851	17	5	6	25	.000045	17	6	6	15	.002499
17	4	7	18	.007958	17	5	6	26	.000019	17	6	6	16	.003634
17	4	7	19	.008118	17	5	7	7	.000001	17	6	6	17	.003892
17	4	7	20	.007311	17	5	7	8	.000004	17	6	6	18	.004434
17	4	7	21	.005610	17	5	7	9	.000022	17	6	6	19	.003251
17	4	7	22	.003957	17	5	7	10	.000083	17	6	6	20	.002912
17	4	7	23	.002182	17	5	7	11	.000253	17	6	6	21	.001332
17	4	7	24	.001195	17	5	7	12	.000643	17	6	6	22	.000934
17	4	7	25	.000429	17	5	7	13	.001399	17	6	6	23	.000205
17	4	7	26	.000178	17	5	7	14	.002578	17	6	6	24	.000110
17	4	7	27	.000032	17	5	7	15	.004175	17	6	7	7	.000001
17	4	7	28	.000010	17	5	7	16	.005899	17	6	7	8	.000007
17	4	8	8	.000002	17	5	7	17	.007110	17	6	7	9	.000029
17	4	8	9	.000013	17	5	7	18	.007913	17	6	7	10	.000094
17	4	8	10	.000062	17	5	7	19	.006921	17	6	7	11	.000263
17	4	8	11	.000232	17	5	7	20	.006068	17	6	7	12	.000605
17	4	8	12	.000701	17	5	7	21	.003664	17	6	7	13	.001206
17	4	8	13	.001743	17	5	7	22	.002495	17	6	7	14	.002129
17	4	8	14	.003630	17	5	7	23	.000938	17	6	7	15	.003005
17	4	8	15	.006394	17	5	7	24	.000485	17	6	7	16	.004128
17	4	8	16	.009607	17	5	7	25	.000086	17	6	7	17	.004039
17	4	8	17	.012381	17	5	7	26	.000032	17	6	7	18	.004289
17	4	8	18	.013674	17	5	8	7	.000001	17	6	7	19	.002776
17	4	8	19	.013003	17	5	8	8	.000006	17	6	7	20	.002249
17	4	8	20	.010585	17	5	8	9	.000030	17	6	7	21	.000865
17	4	8	21	.007319	17	5	8	10	.000116	17	6	7	22	.000523
17	4	8	22	.004363	17	5	8	11	.000359	17	6	7	23	.000090
17	4	8	23	.002093	17	5	8	12	.000909	17	6	7	24	.000039
17	4	8	24	.000903	17	5	8	13	.001918	17	6	8	7	.000002
17	4	8	25	.000269	17	5	8	14	.003389	17	6	8	8	.000009
17	4	8	26	.000082	17	5	8	15	.005095	17	6	8	9	.000037
17	4	8	27	.000011	17	5	8	16	.006464	17	6	8	10	.000120
17	4	8	28	.000002	17	5	8	17	.006985	17	6	8	11	.000317
17	5	6	8	.000001	17	5	8	18	.006473	17	6	8	12	.000673
17	5	6	9	.000006	17	5	8	19	.004941	17	6	8	13	.001201
17	5	6	10	.000022	17	5	8	20	.003377	17	6	8	14	.001764
17	5	6	11	.000067	17	5	8	21	.001729	17	6	8	15	.002170

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
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17	6	8	17	.001935	17	7	7	18	.001104	17	8	7	8	.000005
17	6	8	18	.001508	17	7	7	19	.000438	17	8	7	9	.000019
17	6	8	19	.000824	17	7	7	20	.000297	17	8	7	10	.000055
17	6	8	20	.000457	17	7	7	21	.000052	17	8	7	11	.000112
17	6	8	21	.000147	17	7	7	22	.000025	17	8	7	12	.000229
17	6	8	22	.000055	17	7	8	7	.000002	17	8	7	13	.000282
17	6	8	23	.000008	17	7	8	8	.000009	17	8	7	14	.000410
17	6	8	24	.000002	17	7	8	9	.000031	17	8	7	15	.000302
17	7	5	8	.000002	17	7	8	10	.000080	17	8	7	16	.000313
17	7	5	9	.000007	17	7	8	11	.000172	17	8	7	17	.000128
17	7	5	10	.000025	17	7	8	12	.000295	17	8	7	18	.000094
17	7	5	11	.000067	17	7	8	13	.000412	17	8	7	19	.000016
17	7	5	12	.000164	17	7	8	14	.000504	17	8	7	20	.000008
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17	7	5	19	.000566	17	7	8	21	.000003	17	8	8	13	.000063
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17	7	5	22	.000091	17	8	5	8	.000004	17	8	8	16	.000023
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17	7	6	8	.000005	17	8	5	10	.000054	17	8	8	18	.000003
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17	7	6	16	.002867	17	8	5	18	.000982	17	9	4	15	.000191
17	7	6	17	.002340	17	8	5	19	.000274	17	9	4	16	.000273
17	7	6	18	.002611	17	8	5	20	.000243	17	9	4	17	.000093
17	7	6	19	.001270	17	8	6	7	.000001	17	9	4	18	.000105
17	7	6	20	.001100	17	8	6	8	.000005	17	9	5	7	.000001
17	7	6	21	.000242	17	8	6	9	.000020	17	9	5	8	.000005
17	7	6	22	.000160	17	8	6	10	.000067	17	9	5	9	.000016
17	7	7	7	.000002	17	8	6	11	.000156	17	9	5	10	.000055
17	7	7	8	.000007	17	8	6	12	.000372	17	9	5	11	.000111
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17	7	7	10	.000077	17	8	6	14	.000963	17	9	5	13	.000327
17	7	7	11	.000195	17	8	6	15	.000867	17	9	5	14	.000601
17	7	7	12	.000441	17	8	6	16	.001167	17	9	5	15	.000403
17	7	7	13	.000736	17	8	6	17	.000591	17	9	5	16	.000568
17	7	7	14	.001240	17	8	6	18	.000601	17	9	5	17	.000162
17	7	7	15	.001360	17	8	6	19	.000130	17	9	5	18	.000175
17	7	7	16	.001710	17	8	6	20	.000099	17	9	6	7	.000001

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
17	9	6	8	.000005	17	10	5	15	.000046	17	12	3	9	.000005
17	9	6	9	.000016	17	10	5	16	.000058	17	12	3	10	.000017
17	9	6	10	.000050	17	10	6	7	.000001	17	12	3	11	.000010
17	9	6	11	.000088	17	10	6	8	.000004	17	12	3	12	.000025
17	9	6	12	.000192	17	10	6	9	.000009	17	12	4	7	.000001
17	9	6	13	.000190	17	10	6	10	.000023	17	12	4	8	.000003
17	9	6	14	.000301	17	10	6	11	.000024	17	12	4	9	.000004
17	9	6	15	.000157	17	10	6	12	.000044	17	12	4	10	.000011
17	9	6	16	.000182	17	10	6	13	.000023	17	12	4	11	.000004
17	9	6	17	.000039	17	10	6	14	.000029	17	12	4	12	.000009
17	9	6	18	.000033	17	10	6	15	.000006	17	12	5	8	.000001
17	9	7	7	.000001	17	10	6	16	.000006	17	12	5	9	.000001
17	9	7	8	.000004	17	10	7	7	.000001	17	12	5	10	.000002
17	9	7	9	.000011	17	10	7	8	.000002	17	12	5	12	.000001
17	9	7	10	.000026	17	10	7	9	.000002	17	13	2	8	.000001
17	9	7	11	.000035	17	10	7	10	.000004	17	13	2	9	.000001
17	9	7	12	.000057	17	10	7	11	.000003	17	13	2	10	.000004
17	9	7	13	.000043	17	10	7	12	.000003	17	13	3	7	.000001
17	9	7	14	.000049	17	10	7	13	.000001	17	13	3	8	.000002
17	9	7	15	.000020	17	10	7	14	.000001	17	13	3	9	.000001
17	9	7	16	.000016	17	11	3	8	.000002	17	13	3	10	.000005
17	9	7	17	.000003	17	11	3	9	.000004	17	13	4	8	.000001
17	9	7	18	.000001	17	11	3	10	.000013	17	13	4	10	.000001
17	9	8	7	.000001	17	11	3	11	.000016	17	14	2	8	.000001
17	9	8	8	.000002	17	11	3	12	.000038	18	1	9	23	.000001
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17	9	8	10	.000004	17	11	3	14	.000035	18	1	9	25	.000003
17	9	8	11	.000004	17	11	4	7	.000001	18	1	9	26	.000004
17	9	8	12	.000004	17	11	4	8	.000004	18	1	9	27	.000005
17	9	8	13	.000002	17	11	4	9	.000009	18	1	9	28	.000005
17	9	8	14	.000002	17	11	4	10	.000030	18	1	9	29	.000004
17	9	8	15	.000001	17	11	4	11	.000032	18	1	9	30	.000003
17	10	4	7	.000001	17	11	4	12	.000076	18	1	9	31	.000001
17	10	4	8	.000004	17	11	4	13	.000030	18	1	9	32	.000001
17	10	4	9	.000012	17	11	4	14	.000053	18	2	8	14	.000002
17	10	4	10	.000039	17	11	5	7	.000001	18	2	8	15	.000008
17	10	4	11	.000065	17	11	5	8	.000004	18	2	8	16	.000028
17	10	4	12	.000157	17	11	5	9	.000006	18	2	8	17	.000074
17	10	4	13	.000141	17	11	5	10	.000018	18	2	8	18	.000164
17	10	4	14	.000260	17	11	5	11	.000013	18	2	8	19	.000303
17	10	4	15	.000099	17	11	5	12	.000026	18	2	8	20	.000476
17	10	4	16	.000142	17	11	5	13	.000007	18	2	8	21	.000636
17	10	5	7	.000001	17	11	5	14	.000010	18	2	8	22	.000730
17	10	5	8	.000005	17	11	6	8	.000001	18	2	8	23	.000720
17	10	5	9	.000013	17	11	6	9	.000001	18	2	8	24	.000612
17	10	5	10	.000042	17	11	6	10	.000003	18	2	8	25	.000448
17	10	5	11	.000059	17	11	6	11	.000001	18	2	8	26	.000282
17	10	5	12	.000137	17	11	6	12	.000002	18	2	8	27	.000152
17	10	5	13	.000098	17	12	3	7	.000001	18	2	8	28	.000069
17	10	5	14	.000165	17	12	3	8	.000003	18	2	8	29	.000027

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
18	2	8	30	.000009	18	3	9	16	.002945	18	4	8	21	.009536
18	2	8	31	.000002	18	3	9	17	.005411	18	4	8	22	.007382
18	2	9	13	.000001	18	3	9	18	.008508	18	4	8	23	.004876
18	2	9	14	.000006	18	3	9	19	.011522	18	4	8	24	.002946
18	2	9	15	.000026	18	3	9	20	.013491	18	4	8	25	.001397
18	2	9	16	.000090	18	3	9	21	.013680	18	4	8	26	.000655
18	2	9	17	.000251	18	3	9	22	.012014	18	4	8	27	.000200
18	2	9	18	.000576	18	3	9	23	.009118	18	4	8	28	.000071
18	2	9	19	.001103	18	3	9	24	.005951	18	4	8	29	.000010
18	2	9	20	.001783	18	3	9	25	.003320	18	4	8	30	.000003
18	2	9	21	.002455	18	3	9	26	.001564	18	4	9	9	.000003
18	2	9	22	.002893	18	3	9	27	.000613	18	4	9	10	.000018
18	2	9	23	.002929	18	3	9	28	.000196	18	4	9	11	.000080
18	2	9	24	.002550	18	3	9	29	.000048	18	4	9	12	.000276
18	2	9	25	.001909	18	3	9	30	.000009	18	4	9	13	.000787
18	2	9	26	.001224	18	3	9	31	.000001	18	4	9	14	.001873
18	2	9	27	.000670	18	4	7	9	.000001	18	4	9	15	.003775
18	2	9	28	.000310	18	4	7	10	.000003	18	4	9	16	.006513
18	2	9	29	.000120	18	4	7	11	.000013	18	4	9	17	.009668
18	2	9	30	.000038	18	4	7	12	.000045	18	4	9	18	.012404
18	2	9	31	.000009	18	4	7	13	.000127	18	4	9	19	.013777
18	2	9	32	.000002	18	4	7	14	.000302	18	4	9	20	.013216
18	3	8	10	.000001	18	4	7	15	.000613	18	4	9	21	.010945
18	3	8	11	.000006	18	4	7	16	.001074	18	4	9	22	.007755
18	3	8	12	.000027	18	4	7	17	.001642	18	4	9	23	.004673
18	3	8	13	.000101	18	4	7	18	.002193	18	4	9	24	.002369
18	3	8	14	.000307	18	4	7	19	.002592	18	4	9	25	.000982
18	3	8	15	.000772	18	4	7	20	.002699	18	4	9	26	.000336
18	3	8	16	.001635	18	4	7	21	.002473	18	4	9	27	.000085
18	3	8	17	.002957	18	4	7	22	.002034	18	4	9	28	.000018
18	3	8	18	.004601	18	4	7	23	.001420	18	4	9	29	.000002
18	3	8	19	.006195	18	4	7	24	.000923	18	5	7	8	.000001
18	3	8	20	.007249	18	4	7	25	.000470	18	5	7	9	.000004
18	3	8	21	.007385	18	4	7	26	.000239	18	5	7	10	.000020
18	3	8	22	.006558	18	4	7	27	.000081	18	5	7	11	.000068
18	3	8	23	.005083	18	4	7	28	.000032	18	5	7	12	.000195
18	3	8	24	.003425	18	4	7	29	.000006	18	5	7	13	.000478
18	3	8	25	.002007	18	4	7	30	.000002	18	5	7	14	.001000
18	3	8	26	.001019	18	4	8	9	.000002	18	5	7	15	.001848
18	3	8	27	.000438	18	4	8	10	.000014	18	5	7	16	.002970
18	3	8	28	.000166	18	4	8	11	.000059	18	5	7	17	.004203
18	3	8	29	.000048	18	4	8	12	.000204	18	5	7	18	.005345
18	3	8	30	.000013	18	4	8	13	.000578	18	5	7	19	.005752
18	3	8	31	.000002	18	4	8	14	.001376	18	5	7	20	.005843
18	3	9	10	.000001	18	4	8	15	.002782	18	5	7	21	.004673
18	3	9	11	.000009	18	4	8	16	.004835	18	5	7	22	.003784
18	3	9	12	.000044	18	4	8	17	.007274	18	5	7	23	.002148
18	3	9	13	.000169	18	4	8	18	.009505	18	5	7	24	.001375
18	3	9	14	.000528	18	4	8	19	.010884	18	5	7	25	.000503
18	3	9	15	.001361	18	4	8	20	.010881	18	5	7	26	.000251

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
18	5	7	27	.000045	18	6	6	15	.000648	18	6	9	8	.000003
18	5	7	28	.000017	18	6	6	16	.001030	18	6	9	9	.000013
18	5	8	8	.000001	18	6	6	17	.001323	18	6	9	10	.000050
18	5	8	9	.000008	18	6	6	18	.001667	18	6	9	11	.000150
18	5	8	10	.000036	18	6	6	19	.001567	18	6	9	12	.000370
18	5	8	11	.000125	18	6	6	20	.001575	18	6	9	13	.000763
18	5	8	12	.000360	18	6	6	21	.001040	18	6	9	14	.001300
18	5	8	13	.000868	18	6	6	22	.000835	18	6	9	15	.001886
18	5	8	14	.001775	18	6	6	23	.000353	18	6	9	16	.002269
18	5	8	15	.003144	18	6	6	24	.000225	18	6	9	17	.002321
18	5	8	16	.004786	18	6	6	25	.000047	18	6	9	18	.001978
18	5	8	17	.006366	18	6	6	26	.000024	18	6	9	19	.001399
18	5	8	18	.007437	18	6	7	8	.000002	18	6	9	20	.000831
18	5	8	19	.007417	18	6	7	9	.000008	18	6	9	21	.000387
18	5	8	20	.006799	18	6	7	10	.000030	18	6	9	22	.000152
18	5	8	21	.004954	18	6	7	11	.000096	18	6	9	23	.000042
18	5	8	22	.003583	18	6	7	12	.000251	18	6	9	24	.000010
18	5	8	23	.001802	18	6	7	13	.000581	18	6	9	25	.000001
18	5	8	24	.001008	18	6	7	14	.001172	18	7	6	8	.000001
18	5	8	25	.000312	18	6	7	15	.002002	18	7	6	9	.000006
18	5	8	26	.000129	18	6	7	16	.003180	18	7	6	10	.000022
18	5	8	27	.000018	18	6	7	17	.003978	18	7	6	11	.000067
18	5	8	28	.000005	18	6	7	18	.005002	18	7	6	12	.000180
18	5	9	8	.000002	18	6	7	19	.004492	18	7	6	13	.000390
18	5	9	9	.000010	18	6	7	20	.004475	18	7	6	14	.000794
18	5	9	10	.000042	18	6	7	21	.002757	18	7	6	15	.001227
18	5	9	11	.000148	18	6	7	22	.002167	18	7	6	16	.001956
18	5	9	12	.000425	18	6	7	23	.000827	18	7	6	17	.002138
18	5	9	13	.001020	18	6	7	24	.000507	18	7	6	18	.002702
18	5	9	14	.002068	18	6	7	25	.000091	18	7	6	19	.002012
18	5	9	15	.003569	18	6	7	26	.000042	18	7	6	20	.002026
18	5	9	16	.005245	18	6	8	8	.000003	18	7	6	21	.000936
18	5	9	17	.006622	18	6	8	9	.000012	18	7	6	22	.000750
18	5	9	18	.007110	18	6	8	10	.000044	18	7	6	23	.000165
18	5	9	19	.006544	18	6	8	11	.000135	18	7	6	24	.000104
18	5	9	20	.005089	18	6	8	12	.000338	18	7	7	8	.000002
18	5	9	21	.003328	18	6	8	13	.000726	18	7	7	9	.000009
18	5	9	22	.001829	18	6	8	14	.001319	18	7	7	10	.000030
18	5	9	23	.000805	18	6	8	15	.002056	18	7	7	11	.000091
18	5	9	24	.000298	18	6	8	16	.002859	18	7	7	12	.000238
18	5	9	25	.000080	18	6	8	17	.003228	18	7	7	13	.000495
18	5	9	26	.000018	18	6	8	18	.003518	18	7	7	14	.000984
18	5	9	27	.000002	18	6	8	19	.002803	18	7	7	15	.001425
18	6	6	8	.000001	18	6	8	20	.002372	18	7	7	16	.002190
18	6	6	9	.000002	18	6	8	21	.001264	18	7	7	17	.002186
18	6	6	10	.000009	18	6	8	22	.000806	18	7	7	18	.002615
18	6	6	11	.000029	18	6	8	23	.000257	18	7	7	19	.001723
18	6	6	12	.000079	18	6	8	24	.000118	18	7	7	20	.001602
18	6	6	13	.000184	18	6	8	25	.000017	18	7	7	21	.000627
18	6	6	14	.000374	18	6	8	26	.000005	18	7	7	22	.000447

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
18	7	7	23	.000078	18	8	5	22	.000069	18	8	9	10	.000020
18	7	7	24	.000042	18	8	6	8	.000002	18	8	9	11	.000037
18	7	8	7	.000001	18	8	6	9	.000007	18	8	9	12	.000054
18	7	8	8	.000003	18	8	6	10	.000026	18	8	9	13	.000066
18	7	8	9	.000012	18	8	6	11	.000072	18	8	9	14	.000065
18	7	8	10	.000037	18	8	6	12	.000191	18	8	9	15	.000051
18	7	8	11	.000099	18	8	6	13	.000359	18	8	9	16	.000033
18	7	8	12	.000219	18	8	6	14	.000729	18	8	9	17	.000016
18	7	8	13	.000405	18	8	6	15	.000923	18	8	9	18	.000007
18	7	8	14	.000682	18	8	6	16	.001460	18	8	9	19	.000002
18	7	8	15	.000874	18	8	6	17	.001207	18	9	5	8	.000001
18	7	8	16	.001124	18	8	6	18	.001503	18	9	5	9	.000006
18	7	8	17	.000980	18	8	6	19	.000738	18	9	5	10	.000020
18	7	8	18	.000943	18	8	6	20	.000724	18	9	5	11	.000049
18	7	8	19	.000533	18	8	6	21	.000160	18	9	5	12	.000130
18	7	8	20	.000375	18	8	6	22	.000123	18	9	5	13	.000212
18	7	8	21	.000124	18	8	7	8	.000002	18	9	5	14	.000428
18	7	8	22	.000062	18	8	7	9	.000008	18	9	5	15	.000445
18	7	8	23	.000009	18	8	7	10	.000027	18	9	5	16	.000706
18	7	8	24	.000003	18	8	7	11	.000072	18	9	5	17	.000433
18	7	9	7	.000001	18	8	7	12	.000180	18	9	5	18	.000544
18	7	9	8	.000003	18	8	7	13	.000306	18	9	5	19	.000152
18	7	9	9	.000013	18	8	7	14	.000572	18	9	5	20	.000152
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18	7	9	11	.000102	18	8	7	16	.000902	18	9	6	9	.000007
18	7	9	12	.000202	18	8	7	17	.000636	18	9	6	10	.000024
18	7	9	13	.000338	18	8	7	18	.000679	18	9	6	11	.000057
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18	7	9	15	.000510	18	8	7	20	.000220	18	9	6	13	.000219
18	7	9	16	.000472	18	8	7	21	.000039	18	9	6	14	.000427
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18	7	9	18	.000224	18	8	8	7	.000001	18	9	6	16	.000583
18	7	9	19	.000109	18	8	8	8	.000002	18	9	6	17	.000299
18	7	9	20	.000044	18	8	8	9	.000008	18	9	6	18	.000344
18	7	9	21	.000012	18	8	8	10	.000022	18	9	6	19	.000075
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18	8	5	8	.000001	18	8	8	12	.000105	18	9	7	8	.000002
18	8	5	9	.000003	18	8	8	13	.000153	18	9	7	9	.000006
18	8	5	10	.000009	18	8	8	14	.000228	18	9	7	10	.000020
18	8	5	11	.000026	18	8	8	15	.000215	18	9	7	11	.000042
18	8	5	12	.000069	18	8	8	16	.000229	18	9	7	12	.000094
18	8	5	13	.000133	18	8	8	17	.000136	18	9	7	13	.000118
18	8	5	14	.000266	18	8	8	18	.000103	18	9	7	14	.000193
18	8	5	15	.000353	18	8	8	19	.000035	18	9	7	15	.000144
18	8	5	16	.000554	18	8	8	20	.000018	18	9	7	16	.000173
18	8	5	17	.000492	18	8	8	21	.000003	18	9	7	17	.000071
18	8	5	18	.000614	18	8	8	22	.000001	18	9	7	18	.000063
18	8	5	19	.000334	18	8	9	7	.000001	18	9	7	19	.000011
18	8	5	20	.000334	18	8	9	8	.000003	18	9	7	20	.000007
18	8	5	21	.000086	18	8	9	9	.000009	18	9	8	8	.000001

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
18	9	8	9	.000004	18	10	6	18	.000020	18	11	7	12	.000002
18	9	8	10	.000010	18	10	7	8	.000001	18	11	7	13	.000001
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18	9	8	12	.000028	18	10	7	10	.000010	18	12	3	8	.000001
18	9	8	13	.000028	18	10	7	11	.000013	18	12	3	9	.000001
18	9	8	14	.000032	18	10	7	12	.000025	18	12	3	10	.000005
18	9	8	15	.000019	18	10	7	13	.000019	18	12	3	11	.000006
18	9	8	16	.000015	18	10	7	14	.000025	18	12	3	12	.000014
18	9	8	17	.000005	18	10	7	15	.000010	18	12	3	13	.000007
18	9	8	18	.000003	18	10	7	16	.000010	18	12	3	14	.000015
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19	2	9	19	.000316	19	3	9	25	.005168	19	4	9	27	.000596
19	2	9	20	.000599	19	3	9	26	.003103	19	4	9	28	.000219
19	2	9	21	.000966	19	3	9	27	.001610	19	4	9	29	.000055
19	2	9	22	.001338	19	3	9	28	.000717	19	4	9	30	.000015
19	2	9	23	.001600	19	3	9	29	.000268	19	4	9	31	.000002
19	2	9	24	.001658	19	3	9	30	.000085	19	5	7	10	.000002
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19	5	9	12	.000168	19	6	8	20	.004567	19	7	7	11	.000034
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19	5	9	14	.001044	19	6	8	22	.002909	19	7	7	13	.000240
19	5	9	15	.002058	19	6	8	23	.001501	19	7	7	14	.000531
19	5	9	16	.003496	19	6	8	24	.000995	19	7	7	15	.000935
19	5	9	17	.005167	19	6	8	25	.000315	19	7	7	16	.001628
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19	7	9	22	.000087	19	8	8	21	.000091	19	9	7	10	.000010
19	7	9	23	.000024	19	8	8	22	.000056	19	9	7	11	.000026
19	7	9	24	.000008	19	8	8	23	.000008	19	9	7	12	.000071
19	7	9	25	.000001	19	8	8	24	.000004	19	9	7	13	.000122
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N	NK	S	R	P
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20	9	7	10	.000004	20	9	10	14	.000018	20	10	8	11	.000006
20	9	7	11	.000012	20	9	10	15	.000017	20	10	8	12	.000016
20	9	7	12	.000036	20	9	10	16	.000014	20	10	8	13	.000025
20	9	7	13	.000078	20	9	10	17	.000009	20	10	8	14	.000046
20	9	7	14	.000183	20	9	10	18	.000005	20	10	8	15	.000045
20	9	7	15	.000275	20	9	10	19	.000002	20	10	8	16	.000063
20	9	7	16	.000504	20	9	10	20	.000001	20	10	8	17	.000038
20	9	7	17	.000518	20	10	5	10	.000001	20	10	8	18	.000040
20	9	7	18	.000756	20	10	5	11	.000004	20	10	8	19	.000014
20	9	7	19	.000512	20	10	5	12	.000011	20	10	8	20	.000011

N	NK	S	R	P	N	NK	S	R	P	N	NK	S	R	P
20	10	8	21	.000002	20	11	7	12	.000014	20	12	6	18	.000006
20	10	8	22	.000001	20	11	7	13	.000018	20	12	7	10	.000001
20	10	9	9	.000001	20	11	7	14	.000036	20	12	7	11	.000002
20	10	9	10	.000001	20	11	7	15	.000028	20	12	7	12	.000004
20	10	9	11	.000003	20	11	7	16	.000042	20	12	7	13	.000003
20	10	9	12	.000005	20	11	7	17	.000018	20	12	7	14	.000005
20	10	9	13	.000007	20	11	7	18	.000020	20	12	7	15	.000002
20	10	9	14	.000009	20	11	7	19	.000004	20	12	7	16	.000003
20	10	9	15	.000007	20	11	7	20	.000003	20	13	4	10	.000002
20	10	9	16	.000007	20	11	8	10	.000001	20	13	4	11	.000003
20	10	9	17	.000003	20	11	8	11	.000002	20	13	4	12	.000008
20	10	9	18	.000002	20	11	8	12	.000005	20	13	4	13	.000007
20	10	9	19	.000001	20	11	8	13	.000005	20	13	4	14	.000018
20	10	10	10	.000001	20	11	8	14	.000007	20	13	4	15	.000007
20	10	10	11	.000001	20	11	8	15	.000005	20	13	4	16	.000013
20	10	10	12	.000001	20	11	8	16	.000005	20	13	5	10	.000002
20	10	10	13	.000001	20	11	8	17	.000002	20	13	5	11	.000002
20	10	10	14	.000001	20	11	8	18	.000001	20	13	5	12	.000007
20	10	10	15	.000001	20	12	4	10	.000001	20	13	5	13	.000005
20	11	5	9	.000001	20	12	4	11	.000002	20	13	5	14	.000012
20	11	5	10	.000002	20	12	4	12	.000006	20	13	5	15	.000003
20	11	5	11	.000006	20	12	4	13	.000008	20	13	5	16	.000006
20	11	5	12	.000019	20	12	4	14	.000019	20	13	6	10	.000001
20	11	5	13	.000032	20	12	4	15	.000014	20	13	6	11	.000001
20	11	5	14	.000074	20	12	4	16	.000026	20	13	6	12	.000003
20	11	5	15	.000078	20	12	4	17	.000009	20	13	6	13	.000001
20	11	5	16	.000147	20	12	4	18	.000014	20	13	6	14	.000003
20	11	5	17	.000091	20	12	5	9	.000001	20	13	6	15	.000001
20	11	5	18	.000137	20	12	5	10	.000002	20	13	6	16	.000001
20	11	5	19	.000038	20	12	5	11	.000005	20	14	3	10	.000001
20	11	5	20	.000047	20	12	5	12	.000015	20	14	3	11	.000001
20	11	6	9	.000001	20	12	5	13	.000018	20	14	3	12	.000002
20	11	6	10	.000003	20	12	5	14	.000043	20	14	3	13	.000001
20	11	6	11	.000007	20	12	5	15	.000029	20	14	3	14	.000002
20	11	6	12	.000021	20	12	5	16	.000054	20	14	4	10	.000001
20	11	6	13	.000032	20	12	5	17	.000016	20	14	4	11	.000001
20	11	6	14	.000073	20	12	5	18	.000023	20	14	4	12	.000004
20	11	6	15	.000068	20	12	6	9	.000001	20	14	4	13	.000002
20	11	6	16	.000123	20	12	6	10	.000002	20	14	4	14	.000003
20	11	6	17	.000064	20	12	6	11	.000004	20	14	5	10	.000001
20	11	6	18	.000090	20	12	6	12	.000011	20	14	5	11	.000001
20	11	6	19	.000020	20	12	6	13	.000011	20	14	5	12	.000001
20	11	6	20	.000022	20	12	6	14	.000023	20	14	5	14	.000001
20	11	7	9	.000001	20	12	6	15	.000013	20	15	3	10	.000001
20	11	7	10	.000002	20	12	6	16	.000020	20	15	3	12	.000001
20	11	7	11	.000005	20	12	6	17	.000005					

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