UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
**Sidang 1990/1991**

Oktober/November 1990

DTM 323/2: BIOSTATISTIK

Masa: [2 jam]

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**Bahagian A** adalah **Wajib** dan mengandungi **DUA** soalan.

Tiap-tiap soalan bernilai 20 markah.

**Bahagian B. DUA** soalan mesti dijawab di mana tiap-tiap soalan bernilai 30 markah.

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Bahagian A (Wajib)

1. Di tahun yang lepas suatu kajian intensif telah menunjukkan bahawa min aras karbon monoksida dalam udara untuk sesuatu bandaraya adalah 9.4 ppm. Oleh kerana ini, pihak bandaraya itu telah mengambil beberapa langkah untuk mengurangkan kandungan karbon monoksida dalam udara. Dalam suatu kajian pilot, 18 kawasan telah dipilih secara rawak dalam bandaraya itu dan kandungan karbon monoksida telah direkodkan seperti berikut:

| | | | | | |
|---|---|---|---|---|---|
| 8.6 | 6.4 | 7.2 | 10.5 | 8.7 | 10.7 |
| 5.4 | 5.7 | 3.9 | 4.5 | 3.6 | 7.6 |
| 6.8 | 10.9 | 10.2 | 7.9 | 9.4 | 7.9 |

(a) Berdasarkan min sampel sahaja, adakah data-data ini menunjukkan min aras karbon monoksida dalam bandaraya itu menurun.

(5 markah)

(b) Dengan menggunakan ujian statistik yang tertentu, uji kesimpulan yang anda dapat di atas (a) dan apakah andaian-andaian yang anda ambil dalam membuat ujian statistik itu. Gunakan paras keertian $\alpha = 0.01$.

(15 markah)

...3/-

2. (a) Sekeping duit siling dilambung dengan adil sebanyak 5 kali. Beri jumlah kombinasi di mana terdapat 2 "kepala" dalam lambungan tersebut. Apakah kebarangkalian untuk mendapatkan 3 "kepala" dalam lambungan tersebut?

(10 markah)

(b) Anggapkan bahawa 1% populasi adalah sensitif kepada bulu kucing. Jika 100 orang terpilih secara rawak dari populasi tersebut, berapakah kebarangkalian bahawa sekurang-kurangnya didapati 2, 4 dan 6 orang yang sensitif kepada bulu kucing?

(10 markah)

Bahagian B (Jawab DUA soalan dari yang berikut:-)

3. Berat badan sebelum mengikuti program mengurang berat-badan dan berat badan selepas dua minggu dalam program ini telah direkodkan bagi 25 lelaki. Keputusannya adalah seperti berikut:

| Lelaki | Berat asal | Berat selepas dua minggu |
|---|---|---|
| 1 | 245 | 236 |
| 2 | 190 | 180 |
| 3 | 310 | 302 |
| 4 | 261 | 251 |
| 5 | 224 | 210 |
| 6 | 197 | 183 |
| 7 | 308 | 291 |
| 8 | 325 | 319 |
| 9 | 242 | 231 |
| 10 | 292 | 280 |
| 11 | 231 | 218 |
| 12 | 258 | 245 |
| 13 | 248 | 243 |
| 14 | 186 | 171 |
| 15 | 242 | 340 |
| 16 | 340 | 328 |
| 17 | 266 | 250 |
| 18 | 210 | 204 |
| 19 | 244 | 223 |
| 20 | 222 | 216 |
| 21 | 380 | 370 |
| 22 | 229 | 218 |
| 23 | 316 | 303 |
| 24 | 282 | 276 |
| 25 | 259 | 245 |

Program ini mendakwa bahawa peserta-peserta boleh mengurangkan berat badan mereka lebih dari 10 paun dalam masa dua minggu.

...5/-

(a) Aturkan perbezaan antara berat badan asal dan selepas dua minggu bagi 25 lelaki dalam suatu jadual frekuensi dan lukiskan histogram frekuensi relatif. Adakah histogram anda lukis itu mencadangkan bahawa kekurangan berat badan menghampiri taburan normal?

(10 markah)

(b) Apakah selang keyakinan 90% bagi min kehilangan berat badan dalam dua minggu untuk program ini?

(10 markah)

(c) Dengan menggunakan ujian statistik yang tertentu, adakah data-data ini menyokong dakwaan program itu. Gunakan paras keertian, $\alpha = 0.05$.

(10 markah)

4. Sisabaki aras DDT dalam PPB (bahagian per billion), ditentukan dalam darah ikan dari empat muara sungai. Keputusan adalah seperti berikut.

| Muara Sungai | Aras DDT (PPB dalam darah) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 15 | 11 | 27 | 9 | 33 | 16 | 22 | 28 | 11 | 21 | 17 | 22 |
| B | 6 | 21 | 9 | 13 | 11 | 10 | 15 | 13 | 17 | 12 | 8 | 13 |
| C | 26 | 11 | 9 | 17 | 7 | 24 | 18 | 14 | 13 | 17 | 15 | 19 |
| D | 16 | 28 | 41 | 27 | 16 | 22 | 18 | 37 | 26 | 19 | 32 | 17 |

...6/-

(a) Dengan menggunakan data-data di atas buat suatu jadual ANOVA.

(15 markah)

(b) Pada paras keertian manakah anda boleh menyimpulkan bahawa ada perbezaan di antara aras DDT empat muara sungai itu?

(15 markah)

5. Suatu maklumat telah didapati dari sumber tertentu tentang tekanan darah (mm Hg) dan umur (tahun) dalam manusia. Data-data di bawah menunjukkan tekanan darah dan umur tersebut.

| Umur (tahun) | Tekanan darah sistolik (mm Hg) |
|---|---|
| 30 | 108, 110, 106 |
| 40 | 125, 120, 118, 119 |
| 50 | 132, 137, 134 |
| 60 | 148, 151, 146, 147, 144 |
| 70 | 162, 156, 164, 158, 159 |

(a) Kirakan pekali korelasi (r) dari data-data tersebut.

(5 markah)

(b) Dengan menggunakan ujian statistik yang tertentu, ujikan sama ada pembolehubah tekanan darah mempunyai pertalian yang tinggi dengan pembolehubah umur. Gunakan para keertian $\alpha = 0.05$.

(15 markah)



...7/-

(c) Cari garis regresi (kuasa dua terkecil). Ramalkan tekanan darah sistolik jika umur adalah 45, 55 dan 59 tahun.

(10 markah)

Formula yang mungkin diperlukan

A. AM

(i) $$\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}$$

(ii) $$\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n(n-1)}$$

B. UJIAN STATISTIK t dan z bagi satu sampel

$$t = \frac{\bar{x}-\mu}{s/\sqrt{n}} \qquad z = \frac{\bar{x}-\mu}{s/\sqrt{n}}$$

C. UJIAN STATISTIK t bagi 2 sampel

(i) $$S_p^2 = \frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}$$

(ii) $$t = \frac{\bar{x}_1-\bar{x}_2-0}{S_p\left(\frac{1}{n_1}+\frac{1}{n_2}\right)^{\frac{1}{2}}}$$

(iii) $$S_d^2 = \frac{n\Sigma d^2-(\Sigma d)^2}{n(n-1)}$$

(iv) $$t = \frac{\bar{d}-0}{S_d/\sqrt{n}}$$

...9/-

D. BINOMIAL

(i) $\binom{n}{x} = \dfrac{n!}{x!(n-x)!}$

(ii) $P(x) = \binom{n}{x} p^x q^{n-x}$

E. POISSON

(i) $P(x=k) = \dfrac{\lambda^x e^{-\lambda}}{x!}$

(ii) $\lambda = NP$

F. KORELASI DAN REGRESI

(i) $\Sigma x^2 - \dfrac{(\Sigma x)^2}{n}$

(ii) $\Sigma xy - \dfrac{(\Sigma x)(\Sigma y)}{n}$

(iii) $\dfrac{\Sigma xy - \dfrac{(\Sigma x)(\Sigma y)}{n}}{\Sigma x^2 - \dfrac{(\Sigma x)^2}{n}}$

(iv) $\dfrac{\Sigma xy - \dfrac{(\Sigma x)(\Sigma y)}{n}}{\left\{\left[\Sigma x^2 - \dfrac{(\Sigma x)^2}{n}\right]\left[\Sigma y^2 - \dfrac{(\Sigma y)^2}{n}\right]\right\}^{\frac{1}{2}}}$

(v) $t = \dfrac{r-0}{\left(\dfrac{1-r^2}{n-2}\right)^{\frac{1}{2}}}$

G. ANOVA

$TSS = \Sigma\Sigma Y_{ij}^2 - \dfrac{G^2}{n}$

$SSB = \dfrac{\Sigma T_i^2}{n_i} - \dfrac{G^2}{n}$

Jadual 1

**Values of $e^{-\lambda}$ for the Poisson distribution**

$(0 < \lambda < 1)$

| λ | ·00 | ·01 | ·02 | ·03 | ·04 | ·05 | ·06 | ·07 | ·08 | ·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0·0 | 1·0000 | ·9900 | ·9802 | ·9704 | ·9608 | ·9512 | ·9418 | ·9324 | ·9231 | ·9139 |
| 0·1 | ·9048 | ·8958 | ·8869 | ·8781 | ·8694 | ·8607 | ·8521 | ·8437 | ·8353 | ·8270 |
| 0·2 | ·8187 | ·8106 | ·8025 | ·7945 | ·7866 | ·7788 | ·7711 | ·7634 | ·7558 | ·7483 |
| 0·3 | ·7408 | ·7334 | ·7261 | ·7189 | ·7118 | ·7047 | ·6977 | ·6907 | ·6839 | ·6771 |
| 0·4 | ·6703 | ·6636 | ·6570 | ·6505 | ·6440 | ·6376 | ·6313 | ·6250 | ·6188 | ·6126 |
| 0·5 | ·6065 | ·6005 | ·5945 | ·5886 | ·5827 | ·5770 | ·5712 | ·5655 | ·5599 | ·5543 |
| 0·6 | ·5488 | ·5434 | ·5379 | ·5326 | ·5273 | ·5220 | ·5169 | ·5117 | ·5066 | ·5016 |
| 0·7 | ·4966 | ·4916 | ·4868 | ·4819 | ·4771 | ·4724 | ·4677 | ·4630 | ·4584 | ·4538 |
| 0·8 | ·4493 | ·4449 | ·4404 | ·4360 | ·4317 | ·4274 | ·4232 | ·4190 | ·4148 | ·4107 |
| 0·9 | ·4066 | ·4025 | ·3985 | ·3946 | ·3906 | ·3867 | ·3829 | ·3791 | ·3753 | ·3716 |

$(\lambda = 1, 2, 3, \ldots, 10)$

| λ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| $e^{-\lambda}$ | ·36788 | ·13534 | ·04979 | ·01832 | ·006738 | ·002479 | ·000912 | ·000335 | ·000123 | ·000045 |

To calculate values of $e^{-\lambda}$ for other values of λ use the law of exponents. For instance, $e^{-1·55} = (e^{-1·00})(e^{-0·55}) = (·36788)(·5770) = ·2123$.

. . .11/-

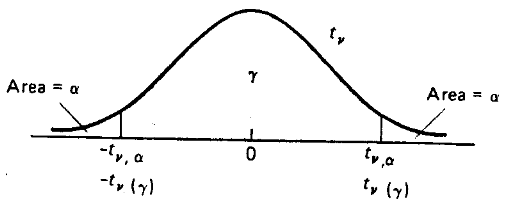
Jadual 2

**Binomial Probabilities**

| n | k | p = .05 | .10 | .15 | .20 | .25 | .30 | .35 | .40 | .45 | .50 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | .9500 | .9000 | .8500 | .8000 | .7500 | .7000 | .6500 | .6000 | .5500 | .5000 |
| | 1 | .0500 | .1000 | .1500 | .2000 | .2500 | .3000 | .3500 | .4000 | .4500 | .5000 |
| 2 | 0 | .9025 | .8100 | .7225 | .6400 | .5625 | .4900 | .4225 | .3600 | .3025 | .2500 |
| | 1 | .0950 | .1800 | .2550 | .3200 | .3750 | .4200 | .4550 | .4800 | .4950 | .5000 |
| | 2 | .0025 | .0100 | .0225 | .0400 | .0625 | .0900 | .1225 | .1600 | .2025 | .2500 |
| 3 | 0 | .8574 | .7290 | .6141 | .5120 | .4219 | .3430 | .2746 | .2160 | .1664 | .1250 |
| | 1 | .1354 | .2430 | .3251 | .3840 | .4219 | .4410 | .4436 | .4320 | .4084 | .3750 |
| | 2 | .0071 | .0270 | .0574 | .0960 | .1406 | .1890 | .2389 | .2880 | .3341 | .3750 |
| | 3 | .0001 | .0010 | .0034 | .0080 | .0156 | .0270 | .0429 | .0640 | .0911 | .1250 |
| 4 | 0 | .8145 | .6561 | .5220 | .4096 | .3164 | .2401 | .1785 | .1296 | .0915 | .0625 |
| | 1 | .1715 | .2916 | .3685 | .4096 | .4219 | .4116 | .3845 | .3456 | .2995 | .2500 |
| | 2 | .0135 | .0486 | .0975 | .1536 | .2109 | .2646 | .3105 | .3456 | .3675 | .3750 |
| | 3 | .0005 | .0036 | .0115 | .0256 | .0469 | .0756 | .1115 | .1536 | .2005 | .2500 |
| | 4 | .0000 | .0001 | .0005 | .0016 | .0039 | .0081 | .0150 | .0256 | .0410 | .0625 |
| 5 | 0 | .7738 | .5905 | .4437 | .3277 | .2373 | .1681 | .1160 | .0778 | .0503 | .0312 |
| | 1 | .2036 | .3280 | .3915 | .4096 | .3955 | .3602 | .3124 | .2592 | .2059 | .1562 |
| | 2 | .0214 | .0729 | .1382 | .2048 | .2637 | .3087 | .3364 | .3456 | .3369 | .3125 |
| | 3 | .0011 | .0081 | .0244 | .0512 | .0879 | .1323 | .1811 | .2304 | .2757 | .3125 |
| | 4 | .0000 | .0004 | .0022 | .0064 | .0146 | .0284 | .0488 | .0768 | .1128 | .1562 |
| | 5 | .0000 | .0000 | .0001 | .0003 | .0010 | .0024 | .0053 | .0102 | .0185 | .0312 |
| 6 | 0 | .7351 | .5314 | .3771 | .2621 | .1780 | .1176 | .0754 | .0467 | .0277 | .0156 |
| | 1 | .2321 | .3543 | .3993 | .3932 | .3560 | .3025 | .2437 | .1866 | .1359 | .0938 |
| | 2 | .0305 | .0984 | .1762 | .2458 | .2966 | .3241 | .3280 | .3110 | .2780 | .2344 |
| | 3 | .0021 | .0146 | .0415 | .0819 | .1318 | .1852 | .2355 | .2765 | .3032 | .3125 |
| | 4 | .0001 | .0012 | .0055 | .0154 | .0330 | .0595 | .0951 | .1382 | .1861 | .2344 |
| | 5 | .0000 | .0001 | .0004 | .0015 | .0044 | .0102 | .0205 | .0369 | .0609 | .0938 |
| | 6 | .0000 | .0000 | .0000 | .0001 | .0002 | .0007 | .0018 | .0041 | .0083 | .0516 |
| 7 | 0 | .6983 | .4783 | .3206 | .2097 | .1335 | .0824 | .0490 | .0280 | .0152 | .0078 |
| | 1 | .2573 | .3720 | .3960 | .3670 | .3115 | .2471 | .1848 | .1306 | .0872 | .0547 |
| | 2 | .0406 | .1240 | .2097 | .2753 | .3115 | .3177 | .2985 | .2613 | .2140 | .1641 |
| | 3 | .0036 | .0230 | .0617 | .1147 | .1730 | .2269 | .2679 | .2903 | .2918 | .2734 |
| | 4 | .0002 | .0026 | .0109 | .0287 | .0577 | .0972 | .1442 | .1935 | .2388 | .2734 |
| | 5 | .0009 | .0002 | .0012 | .0043 | .0115 | .0250 | .0466 | .0774 | .1172 | .1641 |
| | 6 | .0000 | .0000 | .0001 | .0004 | .0013 | .0036 | .0084 | .0172 | .0320 | .0547 |
| | 7 | .0000 | .0000 | .0000 | .0000 | .0001 | .0002 | .0006 | .0016 | .0037 | .0078 |
| 8 | 0 | .6634 | .4305 | .2725 | .1678 | .1001 | .0576 | .0319 | .0168 | .0084 | .0039 |
| | 1 | .2793 | .3826 | .3847 | .3355 | .2670 | .1977 | .1373 | .0896 | .0548 | .0312 |
| | 2 | .0515 | .1488 | .2376 | .2936 | .3115 | .2965 | .2587 | .2090 | .1569 | .1094 |
| | 3 | .0054 | .0331 | .0839 | .1468 | .2076 | .2541 | .2786 | .2787 | .2568 | .2188 |
| | 4 | .0004 | .0046 | .0815 | .0459 | .0865 | .1361 | .1875 | .2322 | .2627 | .2734 |

...12/-

Jadual 3



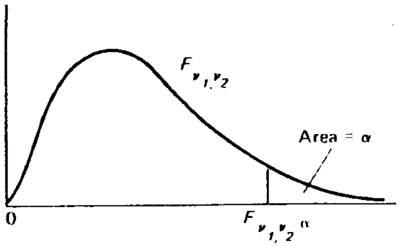

The *t* distribution

| | $t_{\nu,.25}$ $t_{\nu(.5)}$ | $t_{\nu,.2}$ $t_{\nu(.6)}$ | $t_{\nu,.15}$ $t_{\nu(.7)}$ | $t_{\nu,.1}$ $t_{\nu(.8)}$ | $t_{\nu,.05}$ $t_{\nu(.9)}$ | $t_{\nu,.025}$ $t_{\nu(.95)}$ | $t_{\nu,.01}$ $t_{\nu(.98)}$ | $t_{\nu,.005}$ $t_{\nu(.99)}$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 1.376 | 1.963 | 3.078 | 6.314 | 12.706 | 31.821 | 63.657 |
| 2 | .817 | 1.061 | 1.386 | 1.886 | 2.920 | 4.303 | 6.965 | 9.925 |
| 3 | .765 | .978 | 1.250 | 1.638 | 2.353 | 3.183 | 4.541 | 5.841 |
| 4 | .741 | .941 | 1.190 | 1.533 | 2.132 | 2.776 | 3.747 | 4.604 |
| 5 | .727 | .920 | 1.156 | 1.476 | 2.015 | 2.571 | 3.365 | 4.032 |
| 6 | .718 | .906 | 1.134 | 1.440 | 1.943 | 2.447 | 3.143 | 3.707 |
| 7 | .711 | .896 | 1.119 | 1.415 | 1.895 | 2.365 | 2.998 | 3.500 |
| 8 | .706 | .889 | 1.108 | 1.397 | 1.860 | 2.306 | 2.896 | 3.355 |
| 9 | .703 | .883 | 1.100 | 1.383 | 1.833 | 2.262 | 2.821 | 3.250 |
| 10 | .700 | .879 | 1.093 | 1.372 | 1.813 | 2.228 | 2.764 | 3.169 |
| 11 | .697 | .876 | 1.088 | 1.363 | 1.796 | 2.201 | 2.718 | 3.106 |
| 12 | .696 | .873 | 1.083 | 1.356 | 1.782 | 2.179 | 2.681 | 3.055 |
| 13 | .694 | .870 | 1.079 | 1.350 | 1.771 | 2.160 | 2.650 | 3.012 |
| 14 | .692 | .868 | 1.076 | 1.345 | 1.761 | 2.145 | 2.624 | 2.977 |
| 15 | .691 | .866 | 1.074 | 1.341 | 1.753 | 2.132 | 2.602 | 2.947 |
| 16 | .690 | .865 | 1.071 | 1.337 | 1.746 | 2.120 | 2.583 | 2.921 |
| 17 | .689 | .863 | 1.069 | 1.333 | 1.740 | 2.110 | 2.567 | 2.898 |
| 18 | .688 | .862 | 1.067 | 1.330 | 1.734 | 2.101 | 2.552 | 2.878 |
| 19 | .688 | .861 | 1.066 | 1.328 | 1.729 | 2.093 | 2.539 | 2.861 |
| 20 | .687 | .860 | 1.064 | 1.325 | 1.725 | 2.086 | 2.528 | 2.845 |
| 21 | .686 | .859 | 1.063 | 1.323 | 1.721 | 2.080 | 2.518 | 2.831 |
| 22 | .686 | .858 | 1.061 | 1.321 | 1.717 | 2.074 | 2.508 | 2.819 |
| 23 | .685 | .858 | 1.060 | 1.319 | 1.714 | 2.069 | 2.500 | 2.807 |
| 24 | .685 | .857 | 1.059 | 1.318 | 1.711 | 2.064 | 2.492 | 2.797 |
| 25 | .684 | .856 | 1.058 | 1.316 | 1.708 | 2.060 | 2.485 | 2.787 |
| 26 | .684 | .856 | 1.058 | 1.315 | 1.706 | 2.056 | 2.479 | 2.779 |
| 27 | .684 | .855 | 1.057 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 |
| 28 | .683 | .855 | 1.056 | 1.313 | 1.701 | 2.048 | 2.467 | 2.763 |
| 29 | .683 | .854 | 1.055 | 1.311 | 1.699 | 2.045 | 2.462 | 2.756 |
| 30 | .683 | .854 | 1.055 | 1.310 | 1.697 | 2.042 | 2.457 | 2.750 |
| 31 | .683 | .854 | 1.054 | 1.310 | 1.696 | 2.040 | 2.453 | 2.744 |
| 32 | .682 | .853 | 1.054 | 1.309 | 1.694 | 2.037 | 2.449 | 2.739 |
| 33 | .682 | .853 | 1.053 | 1.308 | 1.692 | 2.035 | 2.445 | 2.733 |
| 34 | .682 | .852 | 1.053 | 1.307 | 1.691 | 2.032 | 2.441 | 2.728 |
| 35 | .682 | .852 | 1.052 | 1.306 | 1.690 | 2.030 | 2.438 | 2.724 |
| 36 | .681 | .852 | 1.052 | 1.306 | 1.688 | 2.028 | 2.434 | 2.720 |
| 37 | .681 | .852 | 1.051 | 1.305 | 1.687 | 2.026 | 2.431 | 2.716 |
| 38 | .681 | .851 | 1.051 | 1.304 | 1.686 | 2.024 | 2.428 | 2.712 |
| 39 | .681 | .851 | 1.050 | 1.304 | 1.685 | 2.023 | 2.426 | 2.708 |
| 40 | .681 | .851 | 1.050 | 1.303 | 1.684 | 2.021 | 2.423 | 2.705 |
| 50 | .679 | .849 | 1.047 | 1.299 | 1.676 | 2.009 | 2.403 | 2.678 |
| 60 | .679 | .848 | 1.046 | 1.296 | 1.671 | 2.000 | 2.390 | 2.660 |
| 70 | .678 | .847 | 1.044 | 1.294 | 1.667 | 1.995 | 2.381 | 2.648 |
| 80 | .678 | .846 | 1.043 | 1.292 | 1.664 | 1.990 | 2.374 | 2.639 |
| 90 | .677 | .846 | 1.043 | 1.291 | 1.662 | 1.987 | 2.368 | 2.632 |
| 100 | .677 | .845 | 1.042 | 1.290 | 1.660 | 1.984 | 2.364 | 2.626 |
| ∞ | .674 | .842 | 1.036 | 1.282 | 1.645 | 1.960 | 2.326 | 2.576 |

(DTM 323/2)

Jadual 4

**The *F* distribution**[a]




Entries in the table are $F_{\nu_1,\nu_2,\alpha}$

| $\nu_2$ | $\alpha$ | $\nu_1$: 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 15 | 20 | 24 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (20) | .25 | 1.40 | 1.49 | 1.48 | 1.47 | 1.45 | 1.44 | 1.43 | 1.42 | 1.41 | 1.40 | 1.39 | 1.39 | 1.37 | 1.36 | 1.35 | 1.34 |
| | .1 | 2.97 | 2.59 | 2.38 | 2.25 | 2.16 | 2.09 | 2.04 | 2.00 | 1.96 | 1.94 | 1.91 | 1.89 | 1.84 | 1.79 | 1.77 | 1.74 |
| | .05 | 4.35 | 3.49 | 3.10 | 2.87 | 2.71 | 2.60 | 2.51 | 2.45 | 2.39 | 2.35 | 2.31 | 2.28 | 2.20 | 2.12 | 2.08 | 2.04 |
| | .025 | 5.87 | 4.46 | 3.86 | 3.51 | 3.29 | 3.13 | 3.01 | 2.91 | 2.84 | 2.77 | 2.72 | 2.68 | 2.57 | 2.46 | 2.41 | 2.35 |
| | .01 | 8.10 | 5.85 | 4.94 | 4.43 | 4.10 | 3.87 | 3.70 | 3.56 | 3.46 | 3.37 | 3.29 | 3.23 | 3.09 | 2.94 | 2.86 | 2.78 |
| | .005 | 9.94 | 6.99 | 5.82 | 5.17 | 4.76 | 4.47 | 4.26 | 4.09 | 3.96 | 3.85 | 3.76 | 3.68 | 3.50 | 3.32 | 3.22 | 3.12 |
| (24) | .25 | 1.39 | 1.47 | 1.46 | 1.44 | 1.43 | 1.41 | 1.40 | 1.39 | 1.38 | 1.38 | 1.37 | 1.36 | 1.35 | 1.33 | 1.32 | 1.31 |
| | .1 | 2.93 | 2.54 | 2.33 | 2.19 | 2.10 | 2.04 | 1.98 | 1.94 | 1.91 | 1.88 | 1.85 | 1.83 | 1.78 | 1.73 | 1.70 | 1.67 |
| | .05 | 4.26 | 3.40 | 3.01 | 2.78 | 2.62 | 2.51 | 2.42 | 2.36 | 2.30 | 2.25 | 2.21 | 2.18 | 2.11 | 2.03 | 1.98 | 1.94 |
| | .025 | 5.72 | 4.32 | 3.72 | 3.38 | 3.15 | 2.99 | 2.87 | 2.78 | 2.70 | 2.64 | 2.59 | 2.54 | 2.44 | 2.33 | 2.27 | 2.21 |
| | .01 | 7.82 | 5.61 | 4.72 | 4.22 | 3.90 | 3.67 | 3.50 | 3.36 | 3.26 | 3.17 | 3.09 | 3.03 | 2.89 | 2.74 | 2.66 | 2.58 |
| | .005 | 9.55 | 6.66 | 5.52 | 4.89 | 4.49 | 4.20 | 3.99 | 3.83 | 3.69 | 3.59 | 3.50 | 3.42 | 3.25 | 3.06 | 2.97 | 2.87 |
| (30) | .25 | 1.38 | 1.45 | 1.44 | 1.42 | 1.41 | 1.39 | 1.38 | 1.37 | 1.36 | 1.35 | 1.35 | 1.34 | 1.32 | 1.30 | 1.29 | 1.28 |
| | .1 | 2.88 | 2.49 | 2.28 | 2.14 | 2.05 | 1.98 | 1.93 | 1.88 | 1.85 | 1.82 | 1.79 | 1.77 | 1.72 | 1.67 | 1.64 | 1.61 |
| | .05 | 4.17 | 3.32 | 2.92 | 2.69 | 2.53 | 2.42 | 2.33 | 2.27 | 2.21 | 2.16 | 2.13 | 2.09 | 2.01 | 1.93 | 1.89 | 1.84 |
| | .025 | 5.57 | 4.18 | 3.59 | 3.25 | 3.03 | 2.87 | 2.75 | 2.65 | 2.57 | 2.51 | 2.46 | 2.41 | 2.31 | 2.20 | 2.14 | 2.07 |
| | .01 | 7.56 | 5.39 | 4.51 | 4.02 | 3.70 | 3.47 | 3.30 | 3.17 | 3.07 | 2.98 | 2.91 | 2.84 | 2.70 | 2.55 | 2.47 | 2.39 |
| | .005 | 9.18 | 6.35 | 5.24 | 4.62 | 4.23 | 3.95 | 3.74 | 3.58 | 3.45 | 3.34 | 3.25 | 3.18 | 3.01 | 2.82 | 2.73 | 2.63 |
| (40) | .25 | 1.36 | 1.44 | 1.42 | 1.40 | 1.39 | 1.37 | 1.36 | 1.35 | 1.34 | 1.33 | 1.32 | 1.31 | 1.30 | 1.28 | 1.26 | 1.25 |
| | .1 | 2.84 | 2.44 | 2.23 | 2.09 | 2.00 | 1.93 | 1.87 | 1.83 | 1.79 | 1.76 | 1.73 | 1.71 | 1.66 | 1.61 | 1.57 | 1.54 |
| | .05 | 4.08 | 3.23 | 2.84 | 2.61 | 2.45 | 2.34 | 2.25 | 2.18 | 2.12 | 2.08 | 2.04 | 2.00 | 1.92 | 1.84 | 1.79 | 1.74 |
| | .025 | 5.42 | 4.05 | 3.46 | 3.13 | 2.90 | 2.74 | 2.62 | 2.53 | 2.45 | 2.39 | 2.33 | 2.29 | 2.18 | 2.07 | 2.01 | 1.94 |
| | .01 | 7.31 | 5.18 | 4.31 | 3.83 | 3.51 | 3.29 | 3.12 | 2.99 | 2.89 | 2.80 | 2.73 | 2.66 | 2.52 | 2.37 | 2.29 | 2.20 |
| | .005 | 8.83 | 6.07 | 4.98 | 4.37 | 3.99 | 3.71 | 3.51 | 3.35 | 3.22 | 3.12 | 3.03 | 2.95 | 2.78 | 2.60 | 2.50 | 2.40 |
| (60) | .25 | 1.35 | 1.42 | 1.41 | 1.38 | 1.37 | 1.35 | 1.33 | 1.32 | 1.31 | 1.30 | 1.29 | 1.29 | 1.27 | 1.25 | 1.24 | 1.22 |
| | .1 | 2.79 | 2.39 | 2.18 | 2.04 | 1.95 | 1.87 | 1.82 | 1.77 | 1.74 | 1.71 | 1.68 | 1.66 | 1.60 | 1.54 | 1.51 | 1.48 |
| | .05 | 4.00 | 3.15 | 2.76 | 2.53 | 2.37 | 2.25 | 2.17 | 2.10 | 2.04 | 1.99 | 1.95 | 1.92 | 1.84 | 1.75 | 1.70 | 1.65 |
| | .025 | 5.29 | 3.93 | 3.34 | 3.01 | 2.79 | 2.63 | 2.51 | 2.41 | 2.33 | 2.27 | 2.22 | 2.17 | 2.06 | 1.94 | 1.88 | 1.82 |
| | .01 | 7.08 | 4.98 | 4.13 | 3.65 | 3.34 | 3.12 | 2.95 | 2.82 | 2.72 | 2.63 | 2.56 | 2.50 | 2.35 | 2.20 | 2.12 | 2.03 |
| | .005 | 8.49 | 5.80 | 4.73 | 4.14 | 3.76 | 3.49 | 3.29 | 3.13 | 3.01 | 2.90 | 2.82 | 2.74 | 2.57 | 2.39 | 2.29 | 2.19 |

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