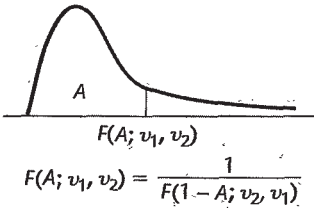


TABLE B.4 Percentiles of the  $F$  Distribution.

Entry is  $F(A; \nu_1, \nu_2)$  where  $P\{F(\nu_1, \nu_2) \leq F(A; \nu_1, \nu_2)\} = A$



$$F(A; \nu_1, \nu_2) = \frac{1}{F(1-A; \nu_2, \nu_1)}$$

TABLE B.4 (continued) Percentiles of the *F* Distribution.

| Den.<br>df | A    | Numerator df |         |         |         |         |         |         |         |         |
|------------|------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|
|            |      | 1            | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       |
| 1          | .50  | 1.00         | 1.50    | 1.71    | 1.82    | 1.89    | 1.94    | 1.98    | 2.00    | 2.03    |
|            | .90  | 39.9         | 49.5    | 53.6    | 55.8    | 57.2    | 58.2    | 58.9    | 59.4    | 59.9    |
|            | .95  | 161          | 200     | 216     | 225     | 230     | 234     | 237     | 239     | 241     |
|            | .975 | 648          | 800     | 864     | 900     | 922     | 937     | 948     | 957     | 963     |
|            | .99  | 4,052        | 5,000   | 5,403   | 5,625   | 5,764   | 5,859   | 5,928   | 5,981   | 6,022   |
|            | .995 | 16,211       | 20,000  | 21,615  | 22,500  | 23,056  | 23,437  | 23,715  | 23,925  | 24,091  |
|            | .999 | 405,280      | 500,000 | 540,380 | 562,500 | 576,400 | 585,940 | 592,870 | 598,140 | 602,280 |
| 2          | .50  | 0.667        | 1.00    | 1.13    | 1.21    | 1.25    | 1.28    | 1.30    | 1.32    | 1.33    |
|            | .90  | 8.53         | 9.00    | 9.16    | 9.24    | 9.29    | 9.33    | 9.35    | 9.37    | 9.38    |
|            | .95  | 18.5         | 19.0    | 19.2    | 19.2    | 19.3    | 19.3    | 19.4    | 19.4    | 19.4    |
|            | .975 | 38.5         | 39.0    | 39.2    | 39.2    | 39.3    | 39.3    | 39.4    | 39.4    | 39.4    |
|            | .99  | 98.5         | 99.0    | 99.2    | 99.2    | 99.3    | 99.3    | 99.4    | 99.4    | 99.4    |
|            | .995 | 199          | 199     | 199     | 199     | 199     | 199     | 199     | 199     | 199     |
|            | .999 | 998.5        | 999.0   | 999.2   | 999.2   | 999.3   | 999.3   | 999.4   | 999.4   | 999.4   |
| 3          | .50  | 0.585        | 0.881   | 1.00    | 1.06    | 1.10    | 1.13    | 1.15    | 1.16    | 1.17    |
|            | .90  | 5.54         | 5.46    | 5.39    | 5.34    | 5.31    | 5.28    | 5.27    | 5.25    | 5.24    |
|            | .95  | 10.1         | 9.55    | 9.28    | 9.12    | 9.01    | 8.94    | 8.89    | 8.85    | 8.81    |
|            | .975 | 17.4         | 16.0    | 15.4    | 15.1    | 14.9    | 14.7    | 14.6    | 14.5    | 14.5    |
|            | .99  | 34.1         | 30.8    | 29.5    | 28.7    | 28.2    | 27.9    | 27.7    | 27.5    | 27.3    |
|            | .995 | 55.6         | 49.8    | 47.5    | 46.2    | 45.4    | 44.8    | 44.4    | 44.1    | 43.9    |
|            | .999 | 167.0        | 148.5   | 141.1   | 137.1   | 134.6   | 132.8   | 131.6   | 130.6   | 129.9   |
| 4          | .50  | 0.549        | 0.828   | 0.941   | 1.00    | 1.04    | 1.06    | 1.08    | 1.09    | 1.10    |
|            | .90  | 4.54         | 4.32    | 4.19    | 4.11    | 4.05    | 4.01    | 3.98    | 3.95    | 3.94    |
|            | .95  | 7.71         | 6.94    | 6.59    | 6.39    | 6.26    | 6.16    | 6.09    | 6.04    | 6.00    |
|            | .975 | 12.2         | 10.6    | 9.98    | 9.60    | 9.36    | 9.20    | 9.07    | 8.98    | 8.90    |
|            | .99  | 21.2         | 18.0    | 16.7    | 16.0    | 15.5    | 15.2    | 15.0    | 14.8    | 14.7    |
|            | .995 | 31.3         | 26.3    | 24.3    | 23.2    | 22.5    | 22.0    | 21.6    | 21.4    | 21.1    |
|            | .999 | 74.1         | 61.2    | 56.2    | 53.4    | 51.7    | 50.5    | 49.7    | 49.0    | 48.5    |
| 5          | .50  | 0.528        | 0.799   | 0.907   | 0.965   | 1.00    | 1.02    | 1.04    | 1.05    | 1.06    |
|            | .90  | 4.06         | 3.78    | 3.62    | 3.52    | 3.45    | 3.40    | 3.37    | 3.34    | 3.32    |
|            | .95  | 6.61         | 5.79    | 5.41    | 5.19    | 5.05    | 4.95    | 4.88    | 4.82    | 4.77    |
|            | .975 | 10.0         | 8.43    | 7.76    | 7.39    | 7.15    | 6.98    | 6.85    | 6.76    | 6.68    |
|            | .99  | 16.3         | 13.3    | 12.1    | 11.4    | 11.0    | 10.7    | 10.5    | 10.3    | 10.2    |
|            | .995 | 22.8         | 18.3    | 16.5    | 15.6    | 14.9    | 14.5    | 14.2    | 14.0    | 13.8    |
|            | .999 | 47.2         | 37.1    | 33.2    | 31.1    | 29.8    | 28.8    | 28.2    | 27.6    | 27.2    |
| 6          | .50  | 0.515        | 0.780   | 0.886   | 0.942   | 0.977   | 1.00    | 1.02    | 1.03    | 1.04    |
|            | .90  | 3.78         | 3.46    | 3.29    | 3.18    | 3.11    | 3.05    | 3.01    | 2.98    | 2.96    |
|            | .95  | 5.99         | 5.14    | 4.76    | 4.53    | 4.39    | 4.28    | 4.21    | 4.15    | 4.10    |
|            | .975 | 8.81         | 7.26    | 6.60    | 6.23    | 5.99    | 5.82    | 5.70    | 5.60    | 5.52    |
|            | .99  | 13.7         | 10.9    | 9.78    | 9.15    | 8.75    | 8.47    | 8.26    | 8.10    | 7.98    |
|            | .995 | 18.6         | 14.5    | 12.9    | 12.0    | 11.5    | 11.1    | 10.8    | 10.6    | 10.4    |
|            | .999 | 35.5         | 27.0    | 23.7    | 21.9    | 20.8    | 20.0    | 19.5    | 19.0    | 18.7    |
| 7          | .50  | 0.506        | 0.767   | 0.871   | 0.926   | 0.960   | 0.983   | 1.00    | 1.01    | 1.02    |
|            | .90  | 3.59         | 3.26    | 3.07    | 2.96    | 2.88    | 2.83    | 2.78    | 2.75    | 2.72    |
|            | .95  | 5.59         | 4.74    | 4.35    | 4.12    | 3.97    | 3.87    | 3.79    | 3.73    | 3.68    |
|            | .975 | 8.07         | 6.54    | 5.89    | 5.52    | 5.29    | 5.12    | 4.99    | 4.90    | 4.82    |
|            | .99  | 12.2         | 9.55    | 8.45    | 7.85    | 7.46    | 7.19    | 6.99    | 6.84    | 6.72    |
|            | .995 | 16.2         | 12.4    | 10.9    | 10.1    | 9.52    | 9.16    | 8.89    | 8.68    | 8.51    |
|            | .999 | 29.2         | 21.7    | 18.8    | 17.2    | 16.2    | 15.5    | 15.0    | 14.6    | 14.3    |

TABLE B.4 (continued) Percentiles of the *F* Distribution.

| Den.<br>df | A    | Numerator df |         |         |         |         |         |         |         |          |
|------------|------|--------------|---------|---------|---------|---------|---------|---------|---------|----------|
|            |      | 10           | 12      | 15      | 20      | 24      | 30      | 60      | 120     | $\infty$ |
| 1          | .50  | 2.04         | 2.07    | 2.09    | 2.12    | 2.13    | 2.15    | 2.17    | 2.18    | 2.20     |
|            | .90  | 60.2         | 60.7    | 61.2    | 61.7    | 62.0    | 62.3    | 62.8    | 63.1    | 63.3     |
|            | .95  | 242          | 244     | 246     | 248     | 249     | 250     | 252     | 253     | 254      |
|            | .975 | 969          | 977     | 985     | 993     | 997     | 1,001   | 1,010   | 1,014   | 1,018    |
|            | .99  | 6,056        | 6,106   | 6,157   | 6,209   | 6,235   | 6,261   | 6,313   | 6,339   | 6,366    |
|            | .995 | 24,224       | 24,426  | 24,630  | 24,836  | 24,940  | 25,044  | 25,253  | 25,359  | 25,464   |
|            | .999 | 605,620      | 610,670 | 615,760 | 620,910 | 623,500 | 626,100 | 631,340 | 633,970 | 636,620  |
| 2          | .50  | 1.34         | 1.36    | 1.38    | 1.39    | 1.40    | 1.41    | 1.43    | 1.43    | 1.44     |
|            | .90  | 9.39         | 9.41    | 9.42    | 9.44    | 9.45    | 9.46    | 9.47    | 9.48    | 9.49     |
|            | .95  | 19.4         | 19.4    | 19.4    | 19.4    | 19.5    | 19.5    | 19.5    | 19.5    | 19.5     |
|            | .975 | 39.4         | 39.4    | 39.4    | 39.4    | 39.5    | 39.5    | 39.5    | 39.5    | 39.5     |
|            | .99  | 99.4         | 99.4    | 99.4    | 99.4    | 99.5    | 99.5    | 99.5    | 99.5    | 99.5     |
|            | .995 | 199          | 199     | 199     | 199     | 199     | 199     | 199     | 199     | 200      |
|            | .999 | 999.4        | 999.4   | 999.4   | 999.4   | 999.5   | 999.5   | 999.5   | 999.5   | 999.5    |
| 3          | .50  | 1.18         | 1.20    | 1.21    | 1.23    | 1.23    | 1.24    | 1.25    | 1.26    | 1.27     |
|            | .90  | 5.23         | 5.22    | 5.20    | 5.18    | 5.18    | 5.17    | 5.15    | 5.14    | 5.13     |
|            | .95  | 8.79         | 8.74    | 8.70    | 8.66    | 8.64    | 8.62    | 8.57    | 8.55    | 8.53     |
|            | .975 | 14.4         | 14.3    | 14.3    | 14.2    | 14.1    | 14.1    | 14.0    | 13.9    | 13.9     |
|            | .99  | 27.2         | 27.1    | 26.9    | 26.7    | 26.6    | 26.5    | 26.3    | 26.2    | 26.1     |
|            | .995 | 43.7         | 43.4    | 43.1    | 42.8    | 42.6    | 42.5    | 42.1    | 42.0    | 41.8     |
|            | .999 | 129.2        | 128.3   | 127.4   | 126.4   | 125.9   | 125.4   | 124.5   | 124.0   | 123.5    |
| 4          | .50  | 1.11         | 1.13    | 1.14    | 1.15    | 1.16    | 1.16    | 1.18    | 1.18    | 1.19     |
|            | .90  | 3.92         | 3.90    | 3.87    | 3.84    | 3.83    | 3.82    | 3.79    | 3.78    | 3.76     |
|            | .95  | 5.96         | 5.91    | 5.86    | 5.80    | 5.77    | 5.75    | 5.69    | 5.66    | 5.63     |
|            | .975 | 8.84         | 8.75    | 8.66    | 8.56    | 8.51    | 8.46    | 8.36    | 8.31    | 8.26     |
|            | .99  | 14.5         | 14.4    | 14.2    | 14.0    | 13.9    | 13.8    | 13.7    | 13.6    | 13.5     |
|            | .995 | 21.0         | 20.7    | 20.4    | 20.2    | 20.0    | 19.9    | 19.6    | 19.5    | 19.3     |
|            | .999 | 48.1         | 47.4    | 46.8    | 46.1    | 45.8    | 45.4    | 44.7    | 44.4    | 44.1     |
| 5          | .50  | 1.07         | 1.09    | 1.10    | 1.11    | 1.12    | 1.12    | 1.14    | 1.14    | 1.15     |
|            | .90  | 3.30         | 3.27    | 3.24    | 3.21    | 3.19    | 3.17    | 3.14    | 3.12    | 3.11     |
|            | .95  | 4.74         | 4.68    | 4.62    | 4.56    | 4.53    | 4.50    | 4.43    | 4.40    | 4.37     |
|            | .975 | 6.62         | 6.52    | 6.43    | 6.33    | 6.28    | 6.23    | 6.12    | 6.07    | 6.02     |
|            | .99  | 10.1         | 9.89    | 9.72    | 9.55    | 9.47    | 9.38    | 9.20    | 9.11    | 9.02     |
|            | .995 | 13.6         | 13.4    | 13.1    | 12.9    | 12.8    | 12.7    | 12.4    | 12.3    | 12.1     |
|            | .999 | 26.9         | 26.4    | 25.9    | 25.4    | 25.1    | 24.9    | 24.3    | 24.1    | 23.8     |
| 6          | .50  | 1.05         | 1.06    | 1.07    | 1.08    | 1.09    | 1.10    | 1.11    | 1.12    | 1.12     |
|            | .90  | 2.94         | 2.90    | 2.87    | 2.84    | 2.82    | 2.80    | 2.76    | 2.74    | 2.72     |
|            | .95  | 4.06         | 4.00    | 3.94    | 3.87    | 3.84    | 3.81    | 3.74    | 3.70    | 3.67     |
|            | .975 | 5.46         | 5.37    | 5.27    | 5.17    | 5.12    | 5.07    | 4.96    | 4.90    | 4.85     |
|            | .99  | 7.87         | 7.72    | 7.56    | 7.40    | 7.31    | 7.23    | 7.06    | 6.97    | 6.88     |
|            | .995 | 10.2         | 10.0    | 9.81    | 9.59    | 9.47    | 9.36    | 9.12    | 9.00    | 8.88     |
|            | .999 | 18.4         | 18.0    | 17.6    | 17.1    | 16.9    | 16.7    | 16.2    | 16.0    | 15.7     |
| 7          | .50  | 1.03         | 1.04    | 1.05    | 1.07    | 1.07    | 1.08    | 1.09    | 1.10    | 1.10     |
|            | .90  | 2.70         | 2.67    | 2.63    | 2.59    | 2.58    | 2.56    | 2.51    | 2.49    | 2.47     |
|            | .95  | 3.64         | 3.57    | 3.51    | 3.44    | 3.41    | 3.38    | 3.30    | 3.27    | 3.23     |
|            | .975 | 4.76         | 4.67    | 4.57    | 4.47    | 4.42    | 4.36    | 4.25    | 4.20    | 4.14     |
|            | .99  | 6.62         | 6.47    | 6.31    | 6.16    | 6.07    | 5.99    | 5.82    | 5.74    | 5.65     |
|            | .995 | 8.38         | 8.18    | 7.97    | 7.75    | 7.65    | 7.53    | 7.31    | 7.19    | 7.08     |
|            | .999 | 14.1         | 13.7    | 13.3    | 12.9    | 12.7    | 12.5    | 12.1    | 11.9    | 11.7     |

TABLE B.4 (continued) Percentiles of the *F* Distribution.

| Den.<br>df | A    | Numerator df |       |       |       |       |       |       |       |       |
|------------|------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|
|            |      | 1            | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     |
| 8          | .50  | 0.499        | 0.757 | 0.860 | 0.915 | 0.948 | 0.971 | 0.988 | 1.00  | 1.01  |
|            | .90  | 3.46         | 3.11  | 2.92  | 2.81  | 2.73  | 2.67  | 2.62  | 2.59  | 2.56  |
|            | .95  | 5.32         | 4.46  | 4.07  | 3.84  | 3.69  | 3.58  | 3.50  | 3.44  | 3.39  |
|            | .975 | 7.57         | 6.06  | 5.42  | 5.05  | 4.82  | 4.65  | 4.53  | 4.43  | 4.36  |
|            | .99  | 11.3         | 8.65  | 7.59  | 7.01  | 6.63  | 6.37  | 6.18  | 6.03  | 5.91  |
|            | .995 | 14.7         | 11.0  | 9.60  | 8.81  | 8.30  | 7.95  | 7.69  | 7.50  | 7.34  |
|            | .999 | 25.4         | 18.5  | 15.8  | 14.4  | 13.5  | 12.9  | 12.4  | 12.0  | 11.8  |
| 9          | .50  | 0.494        | 0.749 | 0.852 | 0.906 | 0.939 | 0.962 | 0.978 | 0.990 | 1.00  |
|            | .90  | 3.36         | 3.01  | 2.81  | 2.69  | 2.61  | 2.55  | 2.51  | 2.47  | 2.44  |
|            | .95  | 5.12         | 4.26  | 3.86  | 3.63  | 3.48  | 3.37  | 3.29  | 3.23  | 3.18  |
|            | .975 | 7.21         | 5.71  | 5.08  | 4.72  | 4.48  | 4.32  | 4.20  | 4.10  | 4.03  |
|            | .99  | 10.6         | 8.02  | 6.99  | 6.42  | 6.06  | 5.80  | 5.61  | 5.47  | 5.35  |
|            | .995 | 13.6         | 10.1  | 8.72  | 7.96  | 7.47  | 7.13  | 6.88  | 6.69  | 6.54  |
|            | .999 | 22.9         | 16.4  | 13.9  | 12.6  | 11.7  | 11.1  | 10.7  | 10.4  | 10.1  |
| 10         | .50  | 0.490        | 0.743 | 0.845 | 0.899 | 0.932 | 0.954 | 0.971 | 0.983 | 0.992 |
|            | .90  | 3.29         | 2.92  | 2.73  | 2.61  | 2.52  | 2.46  | 2.41  | 2.38  | 2.35  |
|            | .95  | 4.96         | 4.10  | 3.71  | 3.48  | 3.33  | 3.22  | 3.14  | 3.07  | 3.02  |
|            | .975 | 6.94         | 5.46  | 4.83  | 4.47  | 4.24  | 4.07  | 3.95  | 3.85  | 3.78  |
|            | .99  | 10.0         | 7.56  | 6.55  | 5.99  | 5.64  | 5.39  | 5.20  | 5.06  | 4.94  |
|            | .995 | 12.8         | 9.43  | 8.08  | 7.34  | 6.87  | 6.54  | 6.30  | 6.12  | 5.97  |
|            | .999 | 21.0         | 14.9  | 12.6  | 11.3  | 10.5  | 9.93  | 9.52  | 9.20  | 8.96  |
| 12         | .50  | 0.484        | 0.735 | 0.835 | 0.888 | 0.921 | 0.943 | 0.959 | 0.972 | 0.981 |
|            | .90  | 3.18         | 2.81  | 2.61  | 2.48  | 2.39  | 2.33  | 2.28  | 2.24  | 2.21  |
|            | .95  | 4.75         | 3.89  | 3.49  | 3.26  | 3.11  | 3.00  | 2.91  | 2.85  | 2.80  |
|            | .975 | 6.55         | 5.10  | 4.47  | 4.12  | 3.89  | 3.73  | 3.61  | 3.51  | 3.44  |
|            | .99  | 9.33         | 6.93  | 5.95  | 5.41  | 5.06  | 4.82  | 4.64  | 4.50  | 4.39  |
|            | .995 | 11.8         | 8.51  | 7.23  | 6.52  | 6.07  | 5.76  | 5.52  | 5.35  | 5.20  |
|            | .999 | 18.6         | 13.0  | 10.8  | 9.63  | 8.89  | 8.38  | 8.00  | 7.71  | 7.48  |
| 15         | .50  | 0.478        | 0.726 | 0.826 | 0.878 | 0.911 | 0.933 | 0.949 | 0.960 | 0.970 |
|            | .90  | 3.07         | 2.70  | 2.49  | 2.36  | 2.27  | 2.21  | 2.16  | 2.12  | 2.09  |
|            | .95  | 4.54         | 3.68  | 3.29  | 3.06  | 2.90  | 2.79  | 2.71  | 2.64  | 2.59  |
|            | .975 | 6.20         | 4.77  | 4.15  | 3.80  | 3.58  | 3.41  | 3.29  | 3.20  | 3.12  |
|            | .99  | 8.68         | 6.36  | 5.42  | 4.89  | 4.56  | 4.32  | 4.14  | 4.00  | 3.89  |
|            | .995 | 10.8         | 7.70  | 6.48  | 5.80  | 5.37  | 5.07  | 4.85  | 4.67  | 4.54  |
|            | .999 | 16.6         | 11.3  | 9.34  | 8.25  | 7.57  | 7.09  | 6.74  | 6.47  | 6.26  |
| 20         | .50  | 0.472        | 0.718 | 0.816 | 0.868 | 0.900 | 0.922 | 0.938 | 0.950 | 0.959 |
|            | .90  | 2.97         | 2.59  | 2.38  | 2.25  | 2.16  | 2.09  | 2.04  | 2.00  | 1.96  |
|            | .95  | 4.35         | 3.49  | 3.10  | 2.87  | 2.71  | 2.60  | 2.51  | 2.45  | 2.39  |
|            | .975 | 5.87         | 4.46  | 3.86  | 3.51  | 3.29  | 3.13  | 3.01  | 2.91  | 2.84  |
|            | .99  | 8.10         | 5.85  | 4.94  | 4.43  | 4.10  | 3.87  | 3.70  | 3.56  | 3.46  |
|            | .995 | 9.94         | 6.99  | 5.82  | 5.17  | 4.76  | 4.47  | 4.26  | 4.09  | 3.96  |
|            | .999 | 14.8         | 9.95  | 8.10  | 7.10  | 6.46  | 6.02  | 5.69  | 5.44  | 5.24  |
| 24         | .50  | 0.469        | 0.714 | 0.812 | 0.863 | 0.895 | 0.917 | 0.932 | 0.944 | 0.953 |
|            | .90  | 2.93         | 2.54  | 2.33  | 2.19  | 2.10  | 2.04  | 1.98  | 1.94  | 1.91  |
|            | .95  | 4.26         | 3.40  | 3.01  | 2.78  | 2.62  | 2.51  | 2.42  | 2.36  | 2.30  |
|            | .975 | 5.72         | 4.32  | 3.72  | 3.38  | 3.15  | 2.99  | 2.87  | 2.78  | 2.70  |
|            | .99  | 7.82         | 5.61  | 4.72  | 4.22  | 3.90  | 3.67  | 3.50  | 3.36  | 3.26  |
|            | .995 | 9.55         | 6.66  | 5.52  | 4.89  | 4.49  | 4.20  | 3.99  | 3.83  | 3.69  |
|            | .999 | 14.0         | 9.34  | 7.55  | 6.59  | 5.98  | 5.55  | 5.23  | 4.99  | 4.80  |

TABLE B.4 (continued) Percentiles of the *F* Distribution.

| Den.<br>df | A    | Numerator df |       |       |       |      |      |      |      |          |
|------------|------|--------------|-------|-------|-------|------|------|------|------|----------|
|            |      | 10           | 12    | 15    | 20    | 24   | 30   | 60   | 120  | $\infty$ |
| 8          | .50  | 1.02         | 1.03  | 1.04  | 1.05  | 1.06 | 1.07 | 1.08 | 1.08 | 1.09     |
|            | .90  | 2.54         | 2.50  | 2.46  | 2.42  | 2.40 | 2.38 | 2.34 | 2.32 | 2.29     |
|            | .95  | 3.35         | 3.28  | 3.22  | 3.15  | 3.12 | 3.08 | 3.01 | 2.97 | 2.93     |
|            | .975 | 4.30         | 4.20  | 4.10  | 4.00  | 3.95 | 3.89 | 3.78 | 3.73 | 3.67     |
|            | .99  | 5.81         | 5.67  | 5.52  | 5.36  | 5.28 | 5.20 | 5.03 | 4.95 | 4.86     |
|            | .995 | 7.21         | 7.01  | 6.81  | 6.61  | 6.50 | 6.40 | 6.18 | 6.06 | 5.95     |
|            | .999 | 11.5         | 11.2  | 10.8  | 10.5  | 10.3 | 10.1 | 9.73 | 9.53 | 9.33     |
| 9          | .50  | 1.01         | 1.02  | 1.03  | 1.04  | 1.05 | 1.05 | 1.07 | 1.07 | 1.08     |
|            | .90  | 2.42         | 2.38  | 2.34  | 2.30  | 2.28 | 2.25 | 2.21 | 2.18 | 2.16     |
|            | .95  | 3.14         | 3.07  | 3.01  | 2.94  | 2.90 | 2.86 | 2.79 | 2.75 | 2.71     |
|            | .975 | 3.96         | 3.87  | 3.77  | 3.67  | 3.61 | 3.56 | 3.45 | 3.39 | 3.33     |
|            | .99  | 5.26         | 5.11  | 4.96  | 4.81  | 4.73 | 4.65 | 4.48 | 4.40 | 4.31     |
|            | .995 | 6.42         | 6.23  | 6.03  | 5.83  | 5.73 | 5.62 | 5.41 | 5.30 | 5.19     |
|            | .999 | 9.89         | 9.57  | 9.24  | 8.90  | 8.72 | 8.55 | 8.19 | 8.00 | 7.81     |
| 10         | .50  | 1.00         | 1.01  | 1.02  | 1.03  | 1.04 | 1.05 | 1.06 | 1.06 | 1.07     |
|            | .90  | 2.32         | 2.28  | 2.24  | 2.20  | 2.18 | 2.16 | 2.11 | 2.08 | 2.06     |
|            | .95  | 2.98         | 2.91  | 2.84  | 2.77  | 2.74 | 2.70 | 2.62 | 2.58 | 2.54     |
|            | .975 | 3.72         | 3.62  | 3.52  | 3.42  | 3.37 | 3.31 | 3.20 | 3.14 | 3.08     |
|            | .99  | 4.85         | 4.71  | 4.56  | 4.41  | 4.33 | 4.25 | 4.08 | 4.00 | 3.91     |
|            | .995 | 5.85         | 5.66  | 5.47  | 5.27  | 5.17 | 5.07 | 4.86 | 4.75 | 4.64     |
|            | .999 | 8.75         | 8.45  | 8.13  | 7.80  | 7.64 | 7.47 | 7.12 | 6.94 | 6.76     |
| 12         | .50  | 0.989        | 1.00  | 1.01  | 1.02  | 1.03 | 1.03 | 1.05 | 1.05 | 1.06     |
|            | .90  | 2.19         | 2.15  | 2.10  | 2.06  | 2.04 | 2.01 | 1.96 | 1.93 | 1.90     |
|            | .95  | 2.75         | 2.69  | 2.62  | 2.54  | 2.51 | 2.47 | 2.38 | 2.34 | 2.30     |
|            | .975 | 3.37         | 3.28  | 3.18  | 3.07  | 3.02 | 2.96 | 2.85 | 2.79 | 2.72     |
|            | .99  | 4.30         | 4.16  | 4.01  | 3.86  | 3.78 | 3.70 | 3.54 | 3.45 | 3.36     |
|            | .995 | 5.09         | 4.91  | 4.72  | 4.53  | 4.43 | 4.33 | 4.12 | 4.01 | 3.90     |
|            | .999 | 7.29         | 7.00  | 6.71  | 6.40  | 6.25 | 6.09 | 5.76 | 5.59 | 5.42     |
| 15         | .50  | 0.977        | 0.989 | 1.00  | 1.01  | 1.02 | 1.02 | 1.03 | 1.04 | 1.05     |
|            | .90  | 2.06         | 2.02  | 1.97  | 1.92  | 1.90 | 1.87 | 1.82 | 1.79 | 1.76     |
|            | .95  | 2.54         | 2.48  | 2.40  | 2.33  | 2.29 | 2.25 | 2.16 | 2.11 | 2.07     |
|            | .975 | 3.06         | 2.96  | 2.86  | 2.76  | 2.70 | 2.64 | 2.52 | 2.46 | 2.40     |
|            | .99  | 3.80         | 3.67  | 3.52  | 3.37  | 3.29 | 3.21 | 3.05 | 2.96 | 2.87     |
|            | .995 | 4.42         | 4.25  | 4.07  | 3.88  | 3.79 | 3.69 | 3.48 | 3.37 | 3.26     |
|            | .999 | 6.08         | 5.81  | 5.54  | 5.25  | 5.10 | 4.95 | 4.64 | 4.48 | 4.31     |
| 20         | .50  | 0.966        | 0.977 | 0.989 | 1.00  | 1.01 | 1.01 | 1.02 | 1.03 | 1.03     |
|            | .90  | 1.94         | 1.89  | 1.84  | 1.79  | 1.77 | 1.74 | 1.68 | 1.64 | 1.61     |
|            | .95  | 2.35         | 2.28  | 2.20  | 2.12  | 2.08 | 2.04 | 1.95 | 1.90 | 1.84     |
|            | .975 | 2.77         | 2.68  | 2.57  | 2.46  | 2.41 | 2.35 | 2.22 | 2.16 | 2.09     |
|            | .99  | 3.37         | 3.23  | 3.09  | 2.94  | 2.86 | 2.78 | 2.61 | 2.52 | 2.42     |
|            | .995 | 3.85         | 3.68  | 3.50  | 3.32  | 3.22 | 3.12 | 2.92 | 2.81 | 2.69     |
|            | .999 | 5.08         | 4.82  | 4.56  | 4.29  | 4.15 | 4.00 | 3.70 | 3.54 | 3.38     |
| 24         | .50  | 0.961        | 0.972 | 0.983 | 0.994 | 1.00 | 1.01 | 1.02 | 1.02 | 1.03     |
|            | .90  | 1.88         | 1.83  | 1.78  | 1.73  | 1.70 | 1.67 | 1.61 | 1.57 | 1.53     |
|            | .95  | 2.25         | 2.18  | 2.11  | 2.03  | 1.98 | 1.94 | 1.84 | 1.79 | 1.73     |
|            | .975 | 2.64         | 2.54  | 2.44  | 2.33  | 2.27 | 2.21 | 2.08 | 2.01 | 1.94     |
|            | .99  | 3.17         | 3.03  | 2.89  | 2.74  | 2.66 | 2.58 | 2.40 | 2.31 | 2.21     |
|            | .995 | 3.59         | 3.42  | 3.25  | 3.06  | 2.97 | 2.87 | 2.66 | 2.55 | 2.43     |
|            | .999 | 4.64         | 4.39  | 4.14  | 3.87  | 3.74 | 3.59 | 3.29 | 3.14 | 2.97     |

TABLE B.4 (continued) Percentiles of the *F* Distribution.

| Den.<br>df | A    | Numerator df |       |       |       |       |       |       |       |       |
|------------|------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|
|            |      | 1            | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     |
| 30         | .50  | 0.466        | 0.709 | 0.807 | 0.858 | 0.890 | 0.912 | 0.927 | 0.939 | 0.948 |
|            | .90  | 2.88         | 2.49  | 2.28  | 2.14  | 2.05  | 1.98  | 1.93  | 1.88  | 1.85  |
|            | .95  | 4.17         | 3.32  | 2.92  | 2.69  | 2.53  | 2.42  | 2.33  | 2.27  | 2.21  |
|            | .975 | 5.57         | 4.18  | 3.59  | 3.25  | 3.03  | 2.87  | 2.75  | 2.65  | 2.57  |
|            | .99  | 7.56         | 5.39  | 4.51  | 4.02  | 3.70  | 3.47  | 3.30  | 3.17  | 3.07  |
|            | .995 | 9.18         | 6.35  | 5.24  | 4.62  | 4.23  | 3.95  | 3.74  | 3.58  | 3.45  |
|            | .999 | 13.3         | 8.77  | 7.05  | 6.12  | 5.53  | 5.12  | 4.82  | 4.58  | 4.39  |
| 60         | .50  | 0.461        | 0.701 | 0.798 | 0.849 | 0.880 | 0.901 | 0.917 | 0.928 | 0.937 |
|            | .90  | 2.79         | 2.39  | 2.18  | 2.04  | 1.95  | 1.87  | 1.82  | 1.77  | 1.74  |
|            | .95  | 4.00         | 3.15  | 2.76  | 2.53  | 2.37  | 2.25  | 2.17  | 2.10  | 2.04  |
|            | .975 | 5.29         | 3.93  | 3.34  | 3.01  | 2.79  | 2.63  | 2.51  | 2.41  | 2.33  |
|            | .99  | 7.08         | 4.98  | 4.13  | 3.65  | 3.34  | 3.12  | 2.95  | 2.82  | 2.72  |
|            | .995 | 8.49         | 5.80  | 4.73  | 4.14  | 3.76  | 3.49  | 3.29  | 3.13  | 3.01  |
|            | .999 | 12.0         | 7.77  | 6.17  | 5.31  | 4.76  | 4.37  | 4.09  | 3.86  | 3.69  |
| 120        | .50  | 0.458        | 0.697 | 0.793 | 0.844 | 0.875 | 0.896 | 0.912 | 0.923 | 0.932 |
|            | .90  | 2.75         | 2.35  | 2.13  | 1.99  | 1.90  | 1.82  | 1.77  | 1.72  | 1.68  |
|            | .95  | 3.92         | 3.07  | 2.68  | 2.45  | 2.29  | 2.18  | 2.09  | 2.02  | 1.96  |
|            | .975 | 5.15         | 3.80  | 3.23  | 2.89  | 2.67  | 2.52  | 2.39  | 2.30  | 2.22  |
|            | .99  | 6.85         | 4.79  | 3.95  | 3.48  | 3.17  | 2.96  | 2.79  | 2.66  | 2.56  |
|            | .995 | 8.18         | 5.54  | 4.50  | 3.92  | 3.55  | 3.28  | 3.09  | 2.93  | 2.81  |
|            | .999 | 11.4         | 7.32  | 5.78  | 4.95  | 4.42  | 4.04  | 3.77  | 3.55  | 3.38  |
| $\infty$   | .50  | 0.455        | 0.693 | 0.789 | 0.839 | 0.870 | 0.891 | 0.907 | 0.918 | 0.927 |
|            | .90  | 2.71         | 2.30  | 2.08  | 1.94  | 1.85  | 1.77  | 1.72  | 1.67  | 1.63  |
|            | .95  | 3.84         | 3.00  | 2.60  | 2.37  | 2.21  | 2.10  | 2.01  | 1.94  | 1.88  |
|            | .975 | 5.02         | 3.69  | 3.12  | 2.79  | 2.57  | 2.41  | 2.29  | 2.19  | 2.11  |
|            | .99  | 6.63         | 4.61  | 3.78  | 3.32  | 3.02  | 2.80  | 2.64  | 2.51  | 2.41  |
|            | .995 | 7.88         | 5.30  | 4.28  | 3.72  | 3.35  | 3.09  | 2.90  | 2.74  | 2.62  |
|            | .999 | 10.8         | 6.91  | 5.42  | 4.62  | 4.10  | 3.74  | 3.47  | 3.27  | 3.10  |

TABLE B.4 (concluded) Percentiles of the *F* Distribution.

| Den.<br>df | A    | Numerator df |       |       |       |       |       |       |       |          |
|------------|------|--------------|-------|-------|-------|-------|-------|-------|-------|----------|
|            |      | 10           | 12    | 15    | 20    | 24    | 30    | 60    | 120   | $\infty$ |
| 30         | .50  | 0.955        | 0.966 | 0.978 | 0.989 | 0.994 | 1.00  | 1.01  | 1.02  | 1.02     |
|            | .90  | 1.82         | 1.77  | 1.72  | 1.67  | 1.64  | 1.61  | 1.54  | 1.50  | 1.46     |
|            | .95  | 2.16         | 2.09  | 2.01  | 1.93  | 1.89  | 1.84  | 1.74  | 1.68  | 1.62     |
|            | .975 | 2.51         | 2.41  | 2.31  | 2.20  | 2.14  | 2.07  | 1.94  | 1.87  | 1.79     |
|            | .99  | 2.98         | 2.84  | 2.70  | 2.55  | 2.47  | 2.39  | 2.21  | 2.11  | 2.01     |
|            | .995 | 3.34         | 3.18  | 3.01  | 2.82  | 2.73  | 2.63  | 2.42  | 2.30  | 2.18     |
|            | .999 | 4.24         | 4.00  | 3.75  | 3.49  | 3.36  | 3.22  | 2.92  | 2.76  | 2.59     |
| 60         | .50  | 0.945        | 0.956 | 0.967 | 0.978 | 0.983 | 0.989 | 1.00  | 1.01  | 1.01     |
|            | .90  | 1.71         | 1.66  | 1.60  | 1.54  | 1.51  | 1.48  | 1.40  | 1.35  | 1.29     |
|            | .95  | 1.99         | 1.92  | 1.84  | 1.75  | 1.70  | 1.65  | 1.53  | 1.47  | 1.39     |
|            | .975 | 2.27         | 2.17  | 2.06  | 1.94  | 1.88  | 1.82  | 1.67  | 1.58  | 1.48     |
|            | .99  | 2.63         | 2.50  | 2.35  | 2.20  | 2.12  | 2.03  | 1.84  | 1.73  | 1.60     |
|            | .995 | 2.90         | 2.74  | 2.57  | 2.39  | 2.29  | 2.19  | 1.96  | 1.83  | 1.69     |
|            | .999 | 3.54         | 3.32  | 3.08  | 2.83  | 2.69  | 2.55  | 2.25  | 2.08  | 1.89     |
| 120        | .50  | 0.939        | 0.950 | 0.961 | 0.972 | 0.978 | 0.983 | 0.994 | 1.00  | 1.01     |
|            | .90  | 1.65         | 1.60  | 1.55  | 1.48  | 1.45  | 1.41  | 1.32  | 1.26  | 1.19     |
|            | .95  | 1.91         | 1.83  | 1.75  | 1.66  | 1.61  | 1.55  | 1.43  | 1.35  | 1.25     |
|            | .975 | 2.16         | 2.05  | 1.95  | 1.82  | 1.76  | 1.69  | 1.53  | 1.43  | 1.31     |
|            | .99  | 2.47         | 2.34  | 2.19  | 2.03  | 1.95  | 1.86  | 1.66  | 1.53  | 1.38     |
|            | .995 | 2.71         | 2.54  | 2.37  | 2.19  | 2.09  | 1.98  | 1.75  | 1.61  | 1.43     |
|            | .999 | 3.24         | 3.02  | 2.78  | 2.53  | 2.40  | 2.26  | 1.95  | 1.77  | 1.54     |
| $\infty$   | .50  | 0.934        | 0.945 | 0.956 | 0.967 | 0.972 | 0.978 | 0.989 | 0.994 | 1.00     |
|            | .90  | 1.60         | 1.55  | 1.49  | 1.42  | 1.38  | 1.34  | 1.24  | 1.17  | 1.00     |
|            | .95  | 1.83         | 1.75  | 1.67  | 1.57  | 1.52  | 1.46  | 1.32  | 1.22  | 1.00     |
|            | .975 | 2.05         | 1.94  | 1.83  | 1.71  | 1.64  | 1.57  | 1.39  | 1.27  | 1.00     |
|            | .99  | 2.32         | 2.18  | 2.04  | 1.88  | 1.79  | 1.70  | 1.47  | 1.32  | 1.00     |
|            | .995 | 2.52         | 2.36  | 2.19  | 2.00  | 1.90  | 1.79  | 1.53  | 1.36  | 1.00     |
|            | .999 | 2.96         | 2.74  | 2.51  | 2.27  | 2.13  | 1.99  | 1.66  | 1.45  | 1.00     |

Source: Reprinted from Table 5 of Pearson and Hartley, *Biometrika Tables for Statisticians*, Volume 2, 1972, published by the Cambridge University Press, on behalf of The Biometrika Society, by permission of the authors and publishers.