# 103年公務人員高等考試三級考試試題　　代號：23880

類　　科：醫務管理
科　　目：生物統計學與流行病學
考試時間：2小時　　座號：＿＿＿＿＿＿＿＿

※注意：㈠可以使用電子計算器，須詳列解答過程。
㈡不必抄題，作答時請將試題題號及答案依照順序寫在試卷上，於本試題上作答者，不予計分。

一、某醫療機構執行健康促進計畫，針對自願參加者進行減重介入，分三種介入方式：跳繩、慢走、飲食改善。結果如下表：

| | 跳繩 | 慢走 | 飲食改善 |
|---|---|---|---|
| 樣本數 | 45 | 31 | 38 |
| 體重下降平均值(公斤) | 8 | 11 | 14 |
| 體重下降標準差(公斤) | 3 | 3 | 2 |

㈠請問三種介入活動是否對體重下降有顯著差異，請檢定之。（15分）
㈡以Scheffe'事後檢定方法，比較飲食改善與跳繩兩組之減重效果是否有統計顯著差異？（查表值取最接近者）（10分）

二、某健康促進業務主管想了解體重（$X$；公斤）與血清總膽固醇（$Y$；mg/dL）之相關，以利未來規劃介入活動之參考，今隨機選取自願受測者10名，得到以下資料（已知$\sum X_i^2 = 38573$；　$\sum Y_i^2 = 344693$；　$\sum X_i Y_i = 114996$）：

| 受測者 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 體重 | 69 | 52 | 73 | 49 | 75 | 61 | 46 | 54 | 78 | 54 |
| 血清總膽固醇 | 200 | 177 | 196 | 155 | 212 | 201 | 150 | 165 | 222 | 163 |

㈠請計算其相關係數（r）。（10分）
㈡計算相關係數（r）之95%信賴區間。（5分）
㈢求最小平方線性迴歸方程式。（5分）
㈣若有一位體重70公斤的受測者，則該受測者之血清總膽固醇預測值及95%信賴區間為何？（5分）

三、請依多重因子之致病機制因果判斷準則（Hill's Rule）來說明某污染源（如：化工廠運轉）與周邊居民健康效應（如：癌症發生率）之因果關係推論，應考慮那些要素？（20分）

（請接第二頁）

類　　科：醫務管理
科　　目：生物統計學與流行病學

四、研究發現苯（Benzene）暴露可能造成白血病（Leukemia），下列為某研究針對職業暴露團體進行之追蹤調查結果：

| | 觀察人年 | 白血病確診案例 |
|---|---|---|
| 苯暴露勞工 | 2387 | 18 |
| <10 年 | 1862 | 10 |
| ≧10 年 | 525 | 8 |
| 非苯暴露勞工 | 5450 | 12 |

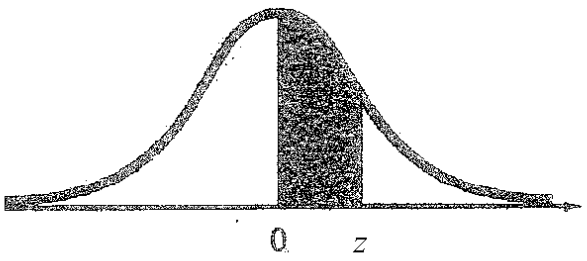
㈠苯暴露與白血病發生之相對危險性（以 Incidence Density Ratio 來表達）為多少？請進行統計顯著性檢定。（15 分）

㈡依苯暴露時間分為非苯暴露、<10 年暴露、≧10 年暴露三組，請依上表數值，進行劑量效應反應關係推論。（15 分）

（請接第三頁）

類　　科：醫務管理
科　　目：生物統計學與流行病學

**TABLE IV　Normal Curve Areas**



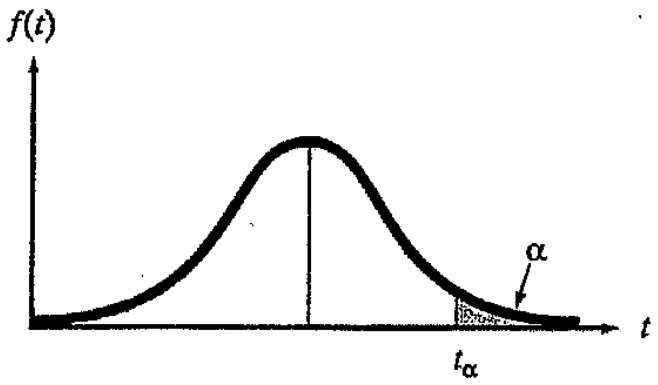

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| .0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0279 | .0319 | .0359 |
| .1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0753 |
| .2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 |
| .3 | .1179 | .1217 | .1255 | .1293 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 |
| .4 | .1554 | .1591 | .1628 | .1664 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 |
| .5 | .1915 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 |
| .6 | .2257 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2517 | .2549 |
| .7 | .2580 | .2611 | .2642 | .2673 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 |
| .8 | .2881 | .2910 | .2939 | .2967 | .2995 | .3023 | .3051 | .3078 | .3106 | .3133 |
| .9 | .3159 | .3186 | .3212 | .3238 | .3264 | .3289 | .3315 | .3340 | .3365 | .3389 |
| 1.0 | .3413 | .3438 | .3461 | .3485 | .3508 | .3531 | .3554 | .3577 | .3599 | .3621 |
| 1.1 | .3643 | .3665 | .3686 | .3708 | .3729 | .3749 | .3770 | .3790 | .3810 | .3830 |
| 1.2 | .3849 | .3869 | .3888 | .3907 | .3925 | .3944 | .3962 | .3980 | .3997 | .4015 |
| 1.3 | .4032 | .4049 | .4066 | .4082 | .4099 | .4115 | .4131 | .4147 | .4162 | .4177 |
| 1.4 | .4192 | .4207 | .4222 | .4236 | .4251 | .4265 | .4279 | .4292 | .4306 | .4319 |
| 1.5 | .4332 | .4345 | .4357 | .4370 | .4382 | .4394 | .4406 | .4418 | .4429 | .4441 |
| 1.6 | .4452 | .4463 | .4474 | .4484 | .4495 | .4505 | .4515 | .4525 | .4535 | .4545 |
| 1.7 | .4554 | .4564 | .4573 | .4582 | .4591 | .4599 | .4608 | .4616 | .4625 | .4633 |
| 1.8 | .4641 | .4649 | .4656 | .4664 | .4671 | .4678 | .4686 | .4693 | .4699 | .4706 |
| 1.9 | .4713 | .4719 | .4726 | .4732 | .4738 | .4744 | .4750 | .4756 | .4761 | .4767 |
| 2.0 | .4772 | .4778 | .4783 | .4788 | .4793 | .4798 | .4803 | .4808 | .4812 | .4817 |
| 2.1 | .4821 | .4826 | .4830 | .4834 | .4838 | .4842 | .4846 | .4850 | .4854 | .4857 |
| 2.2 | .4861 | .4864 | .4868 | .4871 | .4875 | .4878 | .4881 | .4884 | .4887 | .4890 |
| 2.3 | .4893 | .4896 | .4898 | .4901 | .4904 | .4906 | .4909 | .4911 | .4913 | .4916 |
| 2.4 | .4918 | .4920 | .4922 | .4925 | .4927 | .4929 | .4931 | .4932 | .4934 | .4936 |
| 2.5 | .4938 | .4940 | .4941 | .4943 | .4945 | .4946 | .4948 | .4949 | .4951 | .4952 |
| 2.6 | .4953 | .4955 | .4956 | .4957 | .4959 | .4960 | .4961 | .4962 | .4963 | .4964 |
| 2.7 | .4965 | .4966 | .4967 | .4968 | .4969 | .4970 | .4971 | .4972 | .4973 | .4974 |
| 2.8 | .4974 | .4975 | .4976 | .4977 | .4977 | .4978 | .4979 | .4979 | .4980 | .4981 |
| 2.9 | .4981 | .4982 | .4982 | .4983 | .4984 | .4984 | .4985 | .4985 | .4986 | .4986 |
| 3.0 | .4987 | .4987 | .4987 | .4988 | .4988 | .4989 | .4989 | .4989 | .4990 | .4990 |

*Source:* Abridged from Table I of A. Hald, *Statistical Tables and Formulas* (New York: Wiley), 1952. Reproduced by permission of A. Hald.

（請接第四頁）

類　　科：醫務管理
科　　目：生物統計學與流行病學

**TABLE VI　Critical Values of *t***



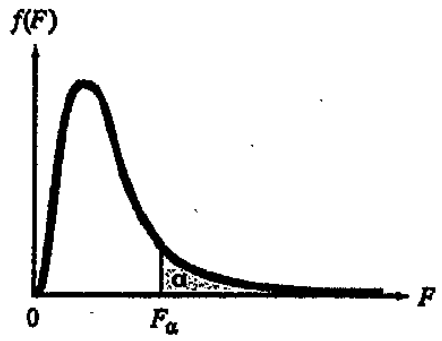

| $\nu$ | $t_{.100}$ | $t_{.050}$ | $t_{.025}$ | $t_{.010}$ | $t_{.005}$ | $t_{.001}$ | $t_{.0005}$ |
|---|---|---|---|---|---|---|---|
| 1 | 3.078 | 6.314 | 12.706 | 31.821 | 63.657 | 318.31 | 636.62 |
| 2 | 1.886 | 2.920 | 4.303 | 6.965 | 9.925 | 22.326 | 31.598 |
| 3 | 1.638 | 2.353 | 3.182 | 4.541 | 5.841 | 10.213 | 12.924 |
| 4 | 1.533 | 2.132 | 2.776 | 3.747 | 4.604 | 7.173 | 8.610 |
| 5 | 1.476 | 2.015 | 2.571 | 3.365 | 4.032 | 5.893 | 6.869 |
| 6 | 1.440 | 1.943 | 2.447 | 3.143 | 3.707 | 5.208 | 5.959 |
| 7 | 1.415 | 1.895 | 2.365 | 2.998 | 3.499 | 4.785 | 5.408 |
| 8 | 1.397 | 1.860 | 2.306 | 2.896 | 3.355 | 4.501 | 5.041 |
| 9 | 1.383 | 1.833 | 2.262 | 2.821 | 3.250 | 4.297 | 4.781 |
| 10 | 1.372 | 1.812 | 2.228 | 2.764 | 3.169 | 4.144 | 4.587 |
| 11 | 1.363 | 1.796 | 2.201 | 2.718 | 3.106 | 4.025 | 4.437 |
| 12 | 1.356 | 1.782 | 2.179 | 2.681 | 3.055 | 3.930 | 4.318 |
| 13 | 1.350 | 1.771 | 2.160 | 2.650 | 3.012 | 3.852 | 4.221 |
| 14 | 1.345 | 1.761 | 2.145 | 2.624 | 2.977 | 3.787 | 4.140 |
| 15 | 1.341 | 1.753 | 2.131 | 2.602 | 2.947 | 3.733 | 4.073 |
| 16 | 1.337 | 1.746 | 2.120 | 2.583 | 2.921 | 3.686 | 4.015 |
| 17 | 1.333 | 1.740 | 2.110 | 2.567 | 2.898 | 3.646 | 3.965 |
| 18 | 1.330 | 1.734 | 2.101 | 2.552 | 2.878 | 3.610 | 3.922 |
| 19 | 1.328 | 1.729 | 2.093 | 2.539 | 2.861 | 3.579 | 3.883 |
| 20 | 1.325 | 1.725 | 2.086 | 2.528 | 2.845 | 3.552 | 3.850 |
| 21 | 1.323 | 1.721 | 2.080 | 2.518 | 2.831 | 3.527 | 3.819 |
| 22 | 1.321 | 1.717 | 2.074 | 2.508 | 2.819 | 3.505 | 3.792 |
| 23 | 1.319 | 1.714 | 2.069 | 2.500 | 2.807 | 3.485 | 3.767 |
| 24 | 1.318 | 1.711 | 2.064 | 2.492 | 2.797 | 3.467 | 3.745 |
| 25 | 1.316 | 1.708 | 2.060 | 2.485 | 2.787 | 3.450 | 3.725 |
| 26 | 1.315 | 1.706 | 2.056 | 2.479 | 2.779 | 3.435 | 3.707 |
| 27 | 1.314 | 1.703 | 2.052 | 2.473 | 2.771 | 3.421 | 3.690 |
| 28 | 1.313 | 1.701 | 2.048 | 2.467 | 2.763 | 3.408 | 3.674 |
| 29 | 1.311 | 1.699 | 2.045 | 2.462 | 2.756 | 3.396 | 3.659 |
| 30 | 1.310 | 1.697 | 2.042 | 2.457 | 2.750 | 3.385 | 3.646 |
| 40 | 1.303 | 1.684 | 2.021 | 2.423 | 2.704 | 3.307 | 3.551 |
| 60 | 1.296 | 1.671 | 2.000 | 2.390 | 2.660 | 3.232 | 3.460 |
| 120 | 1.289 | 1.658 | 1.980 | 2.358 | 2.617 | 3.160 | 3.373 |
| ∞ | 1.282 | 1.645 | 1.960 | 2.326 | 2.576 | 3.090 | 3.291 |

*Source:* This table is reproduced with the kind permission of the Trustees of Biometrika from E. S. Pearson and H. O. Hartley (eds.), *The Biometrika Tables for Statisticians*, Vol. 1, 3d ed., Biometrika, 1966.

（請接第五頁）

類　　科：醫務管理
科　　目：生物統計學與流行病學

**TABLE VIII　Percentage Points of the *F*-distribution, α= .05**




| DENOMINATOR DEGREES OF FREEDOM ($\nu_2$) \ NUMERATOR DEGREES OF FREEDOM ($\nu_1$) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 161.4 | 199.5 | 215.7 | 224.6 | 230.2 | 234.0 | 236.8 | 238.9 | 240.5 |
| 2 | 18.51 | 19.00 | 19.16 | 19.25 | 19.30 | 19.33 | 19.35 | 19.37 | 19.38 |
| 3 | 10.13 | 9.55 | 9.28 | 9.12 | 9.01 | 8.94 | 8.89 | 8.85 | 8.81 |
| 4 | 7.71 | 6.94 | 6.59 | 6.39 | 6.26 | 6.16 | 6.09 | 6.04 | 6.00 |
| 5 | 6.61 | 5.79 | 5.41 | 5.19 | 5.05 | 4.95 | 4.88 | 4.82 | 4.77 |
| 6 | 5.99 | 5.14 | 4.76 | 4.53 | 4.39 | 4.28 | 4.21 | 4.15 | 4.10 |
| 7 | 5.59 | 4.74 | 4.35 | 4.12 | 3.97 | 3.87 | 3.79 | 3.73 | 3.68 |
| 8 | 5.32 | 4.46 | 4.07 | 3.84 | 3.69 | 3.58 | 3.50 | 3.44 | 3.39 |
| 9 | 5.12 | 4.26 | 3.86 | 3.63 | 3.48 | 3.37 | 3.29 | 3.23 | 3.18 |
| 10 | 4.96 | 4.10 | 3.71 | 3.48 | 3.33 | 3.22 | 3.14 | 3.07 | 3.02 |
| 11 | 4.84 | 3.98 | 3.59 | 3.36 | 3.20 | 3.09 | 3.01 | 2.95 | 2.90 |
| 12 | 4.75 | 3.89 | 3.49 | 3.26 | 3.11 | 3.00 | 2.91 | 2.85 | 2.80 |
| 13 | 4.67 | 3.81 | 3.41 | 3.18 | 3.03 | 2.92 | 2.83 | 2.77 | 2.71 |
| 14 | 4.60 | 3.74 | 3.34 | 3.11 | 2.96 | 2.85 | 2.76 | 2.70 | 2.65 |
| 15 | 4.54 | 3.68 | 3.29 | 3.06 | 2.90 | 2.79 | 2.71 | 2.64 | 2.59 |
| 16 | 4.49 | 3.63 | 3.24 | 3.01 | 2.85 | 2.74 | 2.66 | 2.59 | 2.54 |
| 17 | 4.45 | 3.59 | 3.20 | 2.96 | 2.81 | 2.70 | 2.61 | 2.55 | 2.49 |
| 18 | 4.41 | 3.55 | 3.16 | 2.93 | 2.77 | 2.66 | 2.58 | 2.51 | 2.46 |
| 19 | 4.38 | 3.52 | 3.13 | 2.90 | 2.74 | 2.63 | 2.54 | 2.48 | 2.42 |
| 20 | 4.35 | 3.49 | 3.10 | 2.87 | 2.71 | 2.60 | 2.51 | 2.45 | 2.39 |
| 21 | 4.32 | 3.47 | 3.07 | 2.84 | 2.68 | 2.57 | 2.49 | 2.42 | 2.37 |
| 22 | 4.30 | 3.44 | 3.05 | 2.82 | 2.66 | 2.55 | 2.46 | 2.40 | 2.34 |
| 23 | 4.28 | 3.42 | 3.03 | 2.80 | 2.64 | 2.53 | 2.44 | 2.37 | 2.32 |
| 24 | 4.26 | 3.40 | 3.01 | 2.78 | 2.62 | 2.51 | 2.42 | 2.36 | 2.30 |
| 25 | 4.24 | 3.39 | 2.99 | 2.76 | 2.60 | 2.49 | 2.40 | 2.34 | 2.28 |
| 26 | 4.23 | 3.37 | 2.98 | 2.74 | 2.59 | 2.47 | 2.39 | 2.32 | 2.77 |
| 27 | 4.21 | 3.35 | 2.96 | 2.73 | 2.57 | 2.46 | 2.37 | 2.31 | 2.25 |
| 28 | 4.20 | 3.34 | 2.95 | 2.71 | 2.56 | 2.45 | 2.36 | 2.29 | 2.24 |
| 29 | 4.18 | 3.33 | 2.93 | 2.70 | 2.55 | 2.43 | 2.35 | 2.28 | 2.22 |
| 30 | 4.17 | 3.32 | 2.92 | 2.69 | 2.53 | 2.42 | 2.33 | 2.27 | 2.21 |
| 40 | 4.08 | 3.23 | 2.84 | 2.61 | 2.45 | 2.34 | 2.25 | 2.18 | 2.12 |
| 60 | 4.00 | 3.15 | 2.76 | 2.53 | 2.37 | 2.25 | 2.17 | 2.10 | 2.04 |
| 120 | 3.92 | 3.07 | 2.68 | 2.45 | 2.29 | 2.17 | 2.09 | 2.02 | 1.96 |
| ∞ | 3.84 | 3.00 | 2.60 | 2.37 | 2.21 | 2.10 | 2.01 | 1.94 | 1.88 |

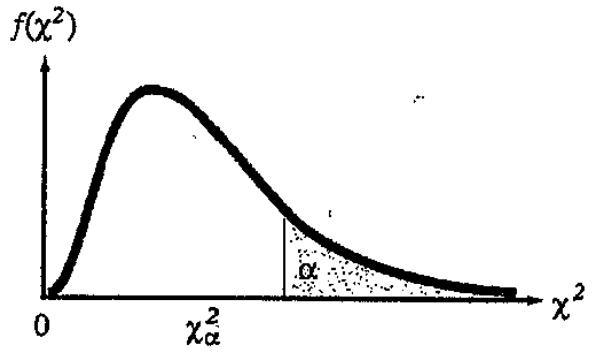
*Source:* From M. Merrington and C. M. Thompson, "Tables of Percentage Points of the Inverted Beta (*F*)-Distribution." *Biometrika*, 1943, 33, 73–88. Reproduced by permission of the *Biometrika* Trustees.

（請接第六頁）

103年公務人員高等考試三級考試試題　　代號：23880

類　　科：醫務管理
科　　目：生物統計學與流行病學

**TABLE XIII Critical Values of $\chi^2$**




| $\chi^2_{0.100}$ | $\chi^2_{0.050}$ | $\chi^2_{0.025}$ | $\chi^2_{0.010}$ | $\chi^2_{0.005}$ | *d.f.* |
|---|---|---|---|---|---|
| 2.705541 | 3.841455 | 5.023903 | 6.634891 | 7.879400 | *1* |
| 4.605176 | 5.991476 | 7.377779 | 9.210351 | 10.5965 | *2* |
| 6.251394 | 7.814725 | 9.348404 | 11.3449 | 12.8381 | *3* |
| 7.779434 | 9.487728 | 11.1433 | 13.2767 | 14.8602 | *4* |
| 9.236349 | 11.0705 | 12.8325 | 15.0863 | 16.7496 | *5* |
| 10.6446 | 12.5916 | 14.4494 | 16.8119 | 18.5475 | *6* |
| 12.0170 | 14.0671 | 16.0128 | 18.4753 | 20.2777 | *7* |
| 13.3616 | 15.5073 | 17.5345 | 20.0902 | 21.9549 | *8* |
| 14.6837 | 16.9190 | 19.0228 | 21.6660 | 23.5893 | *9* |
| 15.9872 | 18.3070 | 20.4832 | 23.2093 | 25.1881 | *10* |
| 17.2750 | 19.6752 | 21.9200 | 24.7250 | 26.7569 | *11* |
| 18.5493 | 21.0261 | 23.3367 | 26.2170 | 28.2997 | *12* |
| 19.8119 | 22.3620 | 24.7356 | 27.6882 | 29.8193 | *13* |
| 21.0641 | 23.6848 | 26.1189 | 29.1412 | 31.3194 | *14* |
| 22.3071 | 24.9958 | 27.4884 | 30.5780 | 32.8015 | *15* |
| 23.5418 | 26.2962 | 28.8453 | 31.9999 | 34.2671 | *16* |
| 24.7690 | 27.5871 | 30.1910 | 33.4087 | 35.7184 | *17* |
| 25.9894 | 28.8693 | 31.5264 | 34.8052 | 37.1564 | *18* |
| 27.2036 | 30.1435 | 32.8523 | 36.1908 | 38.5821 | *19* |
| 28.4120 | 31.4104 | 34.1696 | 37.5663 | 39.9969 | *20* |
| 29.6151 | 32.6706 | 35.4789 | 38.9322 | 41.4009 | *21* |
| 30.8133 | 33.9245 | 36.7807 | 40.2894 | 42.7957 | *22* |
| 32.0069 | 35.1725 | 38.0756 | 41.6383 | 44.1814 | *23* |
| 33.1962 | 36.4150 | 39.3641 | 42.9798 | 45.5584 | *24* |
| 34.3816 | 37.6525 | 40.6465 | 44.3140 | 46.9280 | *25* |
| 35.5632 | 38.8851 | 41.9231 | 45.6416 | 48.2898 | *26* |
| 36.7412 | 40.1133 | 43.1945 | 46.9628 | 49.6450 | *27* |
| 37.9159 | 41.3372 | 44.4608 | 48.2782 | 50.9936 | *28* |
| 39.0875 | 42.5569 | 45.7223 | 49.5878 | 52.3355 | *29* |
| 40.2560 | 43.7730 | 46.9792 | 50.8922 | 53.6719 | *30* |
| 51.8050 | 55.7585 | 59.3417 | 63.6908 | 66.7660 | *40* |
| 63.1671 | 67.5048 | 71.4202 | 76.1538 | 79.4898 | *50* |
| 74.3970 | 79.0820 | 83.2977 | 88.3794 | 91.9518 | *60* |
| 96.5782 | 101.879 | 106.629 | 112.329 | 116.321 | *80* |
| 118.498 | 124.342 | 129.561 | 135.807 | 140.170 | *100* |