

系所組別： 都市計劃學系甲組

考試科目： 統計學

考試日期：0225，節次：1

一、名詞解釋(20分，每題五分)

1. Bernoulli trials
2. Test of homogeneity
3. Central limit theorem
4. Null hypothesis

註：以下每題 20 分

- ◎ 請詳列各計算過程。
- ◎ 小數點後位數請算至小數點後第一位。
- ◎ 資料或條件不足，請自行假設。

二、A population has distribution

| Value | Probability |
|-------|-------------|
| 1     | 0.6         |
| 3     | 0.3         |
| 5     | 0.1         |

Let  $X_1$  and  $X_2$  be independent and each have the same distribution as the population.

1. Determine the missing elements in the table for the sampling distribution of  $\bar{X}=(X_1+X_2)/2$ , and find the expected value of  $\bar{X}$ .

| $\bar{X}$ | Probability |
|-----------|-------------|
| 1         |             |
| 2         | 0.36        |
| 3         | 0.21        |
| 4         |             |
| 5         |             |

2. If the sample size is increased to 36, give the mean and variance of  $\bar{X}$ .

三、台南某工廠採用汙染指標 A 定期監測汙水處理情形，去年進行了 49 次的汙染指標 A 測定，平均值和標準差分別為 5700 和 1701。該工廠出示文件說明汙染指標 A 的平均值已達 6000 以下的標準，試問根據測定樣本數據是否能說明該工廠已符合汙染指標 A 之標準？(請以 p-value 討論)。

四、都市計畫系課程執行一個試驗性的 3D 模型製作教學方案(共兩種訓練方法)，實驗中包含 20 位學生，其中 10 人隨機選中訓練方法 1，其餘 10 人為訓練方法 2，訓練課程結束後，所有學生皆接受 3D 模型操作測試，下表為參與實驗學生的完成速度之平均值及標準差資料，請比較兩訓練方法是否有顯著的訓練成效差異( $\alpha = .05$ )。另計算在 95% 的信心水準下，兩方法訓練後的平均差異時間。

| Time (minutes) |             |         |
|----------------|-------------|---------|
| 訓練方法 1         | Mean1 =19.0 | sd1=5.0 |
| 訓練方法 2         | Mean2=23.0  | sd2=6.0 |

五、一項針對台灣某重大建設投資方案之態度及立場的問卷調查顯示，調查對象包含都市專家學者與一般民眾，調查樣本數共計 400 人，統計結果如下表。請檢驗此觀察差異可否解釋對於該方案之態度與都市專家學者的背景有相關性。

|        | 支持  | 無意見 | 反對  | 總計  |
|--------|-----|-----|-----|-----|
| 都市專家學者 | 110 | 40  | 30  | 180 |
| 一般民眾   | 90  | 60  | 70  | 220 |
| 總計     | 200 | 100 | 100 | 400 |

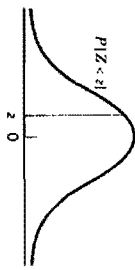
(背面仍有題目,請繼續作答)

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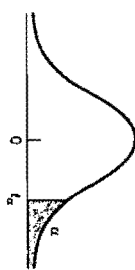
考試日期: 0225, 節次: 1

TABLE Standard Normal Probabilities



| z    | .00   | .01   | .02   | .03   | .04   | .05   | .06   | .07   | .08   | .09   |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| -3.5 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 | .0002 |
| -3.4 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 | .0003 |
| -3.3 | .0005 | .0005 | .0005 | .0004 | .0004 | .0004 | .0004 | .0004 | .0004 | .0004 |
| -3.2 | .0007 | .0007 | .0006 | .0006 | .0006 | .0006 | .0006 | .0005 | .0005 | .0005 |
| -3.1 | .0010 | .0010 | .0009 | .0009 | .0008 | .0008 | .0008 | .0007 | .0007 | .0007 |
| -3.0 | .0013 | .0013 | .0013 | .0012 | .0012 | .0011 | .0011 | .0011 | .0010 | .0010 |
| -2.9 | .0019 | .0018 | .0018 | .0017 | .0016 | .0016 | .0015 | .0015 | .0014 | .0014 |
| -2.8 | .0026 | .0025 | .0024 | .0023 | .0023 | .0022 | .0021 | .0021 | .0020 | .0020 |
| -2.7 | .0035 | .0034 | .0033 | .0032 | .0031 | .0030 | .0029 | .0028 | .0027 | .0026 |
| -2.6 | .0047 | .0045 | .0044 | .0043 | .0041 | .0040 | .0039 | .0038 | .0037 | .0036 |
| -2.5 | .0062 | .0060 | .0059 | .0057 | .0055 | .0052 | .0052 | .0051 | .0049 | .0048 |
| -2.4 | .0082 | .0080 | .0078 | .0075 | .0073 | .0071 | .0069 | .0068 | .0066 | .0064 |
| -2.3 | .0107 | .0104 | .0102 | .0099 | .0096 | .0094 | .0091 | .0089 | .0087 | .0084 |
| -2.2 | .0139 | .0136 | .0132 | .0129 | .0125 | .0122 | .0119 | .0116 | .0113 | .0110 |
| -2.1 | .0179 | .0174 | .0170 | .0166 | .0162 | .0158 | .0154 | .0150 | .0146 | .0143 |
| -2.0 | .0228 | .0222 | .0217 | .0212 | .0207 | .0202 | .0197 | .0192 | .0188 | .0183 |
| -1.9 | .0287 | .0281 | .0274 | .0268 | .0262 | .0256 | .0250 | .0244 | .0239 | .0233 |
| -1.8 | .0359 | .0351 | .0344 | .0336 | .0329 | .0322 | .0314 | .0307 | .0301 | .0294 |
| -1.7 | .0446 | .0436 | .0427 | .0418 | .0409 | .0401 | .0392 | .0384 | .0375 | .0367 |
| -1.6 | .0548 | .0537 | .0526 | .0516 | .0505 | .0495 | .0485 | .0475 | .0465 | .0455 |
| -1.5 | .0668 | .0655 | .0643 | .0630 | .0618 | .0606 | .0594 | .0582 | .0571 | .0559 |
| -1.4 | .0808 | .0793 | .0778 | .0764 | .0749 | .0735 | .0721 | .0708 | .0694 | .0681 |
| -1.3 | .0968 | .0951 | .0934 | .0918 | .0901 | .0885 | .0869 | .0853 | .0838 | .0823 |
| -1.2 | .1151 | .1131 | .1112 | .1093 | .1075 | .1056 | .1038 | .1020 | .1003 | .0985 |
| -1.1 | .1357 | .1335 | .1314 | .1292 | .1271 | .1251 | .1230 | .1210 | .1190 | .1170 |
| -1.0 | .1587 | .1562 | .1539 | .1515 | .1492 | .1469 | .1446 | .1423 | .1401 | .1379 |
| - .9 | .1841 | .1814 | .1788 | .1762 | .1736 | .1711 | .1685 | .1660 | .1635 | .1611 |
| - .8 | .2119 | .2090 | .2061 | .2033 | .2005 | .1977 | .1949 | .1922 | .1894 | .1867 |
| - .7 | .2420 | .2389 | .2358 | .2327 | .2297 | .2266 | .2236 | .2206 | .2177 | .2148 |
| - .6 | .2743 | .2709 | .2676 | .2643 | .2611 | .2578 | .2546 | .2514 | .2483 | .2451 |
| - .5 | .3085 | .3050 | .3015 | .2981 | .2946 | .2912 | .2877 | .2843 | .2810 | .2776 |
| - .4 | .3446 | .3409 | .3372 | .3336 | .3300 | .3264 | .3228 | .3192 | .3156 | .3121 |
| - .3 | .3821 | .3783 | .3745 | .3707 | .3669 | .3632 | .3594 | .3557 | .3520 | .3483 |
| - .2 | .4207 | .4168 | .4129 | .4090 | .4052 | .4013 | .3974 | .3936 | .3897 | .3857 |
| - .1 | .4602 | .4562 | .4522 | .4483 | .4443 | .4404 | .4364 | .4325 | .4286 | .4247 |
| - .0 | .5000 | .4960 | .4920 | .4880 | .4840 | .4801 | .4761 | .4721 | .4681 | .4641 |

TABLE Percentage Points of t Distributions



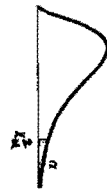
| $\alpha$ | .25   | .10   | .05   | .025   | .01    | .00833 | .00625 | .005   |
|----------|-------|-------|-------|--------|--------|--------|--------|--------|
| 1        | 1.000 | 3.078 | 6.314 | 12.706 | 31.821 | 38.204 | 50.923 | 63.657 |
| 2        | .816  | 1.886 | 2.920 | 4.303  | 6.965  | 7.649  | 8.860  | 9.925  |
| 3        | .765  | 1.638 | 2.353 | 3.182  | 4.541  | 4.857  | 5.392  | 5.841  |
| 4        | .741  | 1.533 | 2.132 | 2.776  | 3.747  | 3.961  | 4.315  | 4.604  |
| 5        | .727  | 1.476 | 2.015 | 2.571  | 3.365  | 3.534  | 3.810  | 4.032  |
| 6        | .718  | 1.440 | 1.943 | 2.447  | 3.143  | 3.287  | 3.521  | 3.707  |
| 7        | .711  | 1.415 | 1.895 | 2.365  | 2.998  | 3.128  | 3.335  | 3.499  |
| 8        | .706  | 1.397 | 1.860 | 2.306  | 2.896  | 3.016  | 3.206  | 3.355  |
| 9        | .703  | 1.383 | 1.833 | 2.262  | 2.821  | 2.933  | 3.111  | 3.250  |
| 10       | .700  | 1.372 | 1.812 | 2.228  | 2.764  | 2.870  | 3.038  | 3.169  |
| 11       | .697  | 1.363 | 1.796 | 2.201  | 2.718  | 2.820  | 2.981  | 3.106  |
| 12       | .695  | 1.356 | 1.782 | 2.179  | 2.681  | 2.779  | 2.934  | 3.055  |
| 13       | .694  | 1.350 | 1.771 | 2.160  | 2.650  | 2.746  | 2.896  | 3.012  |
| 14       | .692  | 1.345 | 1.761 | 2.145  | 2.624  | 2.718  | 2.864  | 2.977  |
| 15       | .691  | 1.341 | 1.753 | 2.131  | 2.602  | 2.694  | 2.837  | 2.947  |
| 16       | .690  | 1.337 | 1.746 | 2.120  | 2.583  | 2.673  | 2.813  | 2.921  |
| 17       | .689  | 1.333 | 1.740 | 2.110  | 2.567  | 2.655  | 2.793  | 2.898  |
| 18       | .688  | 1.330 | 1.734 | 2.101  | 2.552  | 2.639  | 2.775  | 2.878  |
| 19       | .688  | 1.328 | 1.729 | 2.093  | 2.539  | 2.625  | 2.759  | 2.861  |
| 20       | .687  | 1.325 | 1.725 | 2.086  | 2.528  | 2.613  | 2.744  | 2.845  |
| 21       | .686  | 1.323 | 1.721 | 2.080  | 2.518  | 2.601  | 2.732  | 2.831  |
| 22       | .686  | 1.321 | 1.717 | 2.074  | 2.508  | 2.591  | 2.720  | 2.819  |
| 23       | .685  | 1.319 | 1.714 | 2.069  | 2.500  | 2.582  | 2.710  | 2.807  |
| 24       | .685  | 1.318 | 1.711 | 2.064  | 2.492  | 2.574  | 2.700  | 2.797  |
| 25       | .684  | 1.316 | 1.708 | 2.060  | 2.485  | 2.566  | 2.692  | 2.787  |
| 26       | .684  | 1.315 | 1.706 | 2.056  | 2.479  | 2.559  | 2.684  | 2.779  |
| 27       | .684  | 1.314 | 1.703 | 2.052  | 2.473  | 2.552  | 2.676  | 2.771  |
| 28       | .683  | 1.313 | 1.701 | 2.048  | 2.467  | 2.546  | 2.669  | 2.763  |
| 29       | .683  | 1.311 | 1.699 | 2.045  | 2.462  | 2.541  | 2.663  | 2.756  |
| 30       | .683  | 1.310 | 1.697 | 2.042  | 2.457  | 2.536  | 2.657  | 2.750  |
| 40       | .681  | 1.303 | 1.684 | 2.021  | 2.423  | 2.499  | 2.616  | 2.704  |
| 60       | .679  | 1.296 | 1.671 | 2.000  | 2.390  | 2.463  | 2.575  | 2.660  |
| 120      | .677  | 1.289 | 1.658 | 1.980  | 2.358  | 2.428  | 2.536  | 2.617  |
| $\infty$ | .674  | 1.282 | 1.645 | 1.960  | 2.326  | 2.394  | 2.498  | 2.576  |

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TABLE Percentage Points of  $\chi^2$  Distributions



| df  | .99   | .975  | .95   | .90   | .50   | .10    | .05    | .025   | .01    |
|-----|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| 1   | .0002 | .001  | .004  | .02   | .45   | 2.71   | 3.84   | 5.02   | 6.63   |
| 2   | .02   | .05   | .10   | .21   | 1.39  | 4.61   | 5.99   | 7.38   | 9.21   |
| 3   | .11   | .22   | .35   | .58   | 2.37  | 6.25   | 7.81   | 9.35   | 11.34  |
| 4   | .30   | .48   | .71   | 1.06  | 3.36  | 7.78   | 9.49   | 11.14  | 13.28  |
| 5   | .55   | .83   | 1.15  | 1.61  | 4.35  | 9.24   | 11.07  | 12.83  | 15.09  |
| 6   | .87   | 1.24  | 1.64  | 2.20  | 5.35  | 10.64  | 12.59  | 14.45  | 16.81  |
| 7   | 1.24  | 1.69  | 2.17  | 2.83  | 6.35  | 12.02  | 14.07  | 16.01  | 18.48  |
| 8   | 1.65  | 2.18  | 2.73  | 3.49  | 7.34  | 13.36  | 15.51  | 17.53  | 20.09  |
| 9   | 2.09  | 2.70  | 3.33  | 4.17  | 8.34  | 14.68  | 16.92  | 19.02  | 21.67  |
| 10  | 2.56  | 3.24  | 3.94  | 4.87  | 9.34  | 15.99  | 18.31  | 20.48  | 23.21  |
| 11  | 3.05  | 3.81  | 4.57  | 5.58  | 10.34 | 17.28  | 19.68  | 21.92  | 24.72  |
| 12  | 3.57  | 4.40  | 5.23  | 6.30  | 11.34 | 18.55  | 21.03  | 23.34  | 26.22  |
| 13  | 4.11  | 5.01  | 5.89  | 7.04  | 12.34 | 19.81  | 22.36  | 24.74  | 27.69  |
| 14  | 4.66  | 5.62  | 6.57  | 7.79  | 13.34 | 21.06  | 23.68  | 26.12  | 29.14  |
| 15  | 5.23  | 6.26  | 7.26  | 8.55  | 14.34 | 22.31  | 25.00  | 27.49  | 30.56  |
| 16  | 5.81  | 6.90  | 7.96  | 9.31  | 15.34 | 23.54  | 26.30  | 28.85  | 32.00  |
| 17  | 6.41  | 7.56  | 8.67  | 10.09 | 16.34 | 24.77  | 27.59  | 30.19  | 33.41  |
| 18  | 7.01  | 8.23  | 9.39  | 10.86 | 17.34 | 25.99  | 28.87  | 31.53  | 34.81  |
| 19  | 7.63  | 8.90  | 10.12 | 11.65 | 18.34 | 27.20  | 30.14  | 32.85  | 36.19  |
| 20  | 8.26  | 9.59  | 10.85 | 12.44 | 19.34 | 28.41  | 31.41  | 34.17  | 37.57  |
| 21  | 8.90  | 10.28 | 11.59 | 13.24 | 20.34 | 29.62  | 32.67  | 35.48  | 38.93  |
| 22  | 9.54  | 10.98 | 12.34 | 14.04 | 21.34 | 30.81  | 33.92  | 36.78  | 40.29  |
| 23  | 10.20 | 11.69 | 13.09 | 14.85 | 22.34 | 32.01  | 35.17  | 38.08  | 41.64  |
| 24  | 10.86 | 12.40 | 13.85 | 15.66 | 23.34 | 33.20  | 36.42  | 39.36  | 42.98  |
| 25  | 11.52 | 13.11 | 14.61 | 16.47 | 24.34 | 34.38  | 37.65  | 40.65  | 44.31  |
| 26  | 12.20 | 13.84 | 15.38 | 17.29 | 25.34 | 35.56  | 38.89  | 41.92  | 45.64  |
| 27  | 12.88 | 14.57 | 16.15 | 18.11 | 26.34 | 36.74  | 40.11  | 43.19  | 46.96  |
| 28  | 13.56 | 15.30 | 16.93 | 18.94 | 27.34 | 37.92  | 41.34  | 44.46  | 48.28  |
| 29  | 14.26 | 16.04 | 17.71 | 19.77 | 28.34 | 39.09  | 42.56  | 45.72  | 49.59  |
| 30  | 14.95 | 16.78 | 18.49 | 20.60 | 29.34 | 40.26  | 43.77  | 46.98  | 50.89  |
| 40  | 22.16 | 24.42 | 26.51 | 29.05 | 39.34 | 51.81  | 55.76  | 59.34  | 63.69  |
| 50  | 29.71 | 32.35 | 34.76 | 37.69 | 49.33 | 63.17  | 71.42  | 76.15  | 80.83  |
| 60  | 37.48 | 40.47 | 43.19 | 46.46 | 59.33 | 74.40  | 79.08  | 83.30  | 88.38  |
| 70  | 45.44 | 48.75 | 51.74 | 55.33 | 69.33 | 85.53  | 90.53  | 95.02  | 100.43 |
| 80  | 53.54 | 57.15 | 60.39 | 64.28 | 79.33 | 96.58  | 101.88 | 106.63 | 112.33 |
| 90  | 61.75 | 65.64 | 69.13 | 73.29 | 89.33 | 107.57 | 113.15 | 118.14 | 124.12 |
| 100 | 70.06 | 74.22 | 77.93 | 82.36 | 99.33 | 118.50 | 124.34 | 129.56 | 135.81 |