

國立臺灣科技大學

九十二學年度碩士班招生考試試題

系所組別：企業管理系碩士班甲組

科目：統計學

總分 100 分

1. High school graduates in Taiwan are required to take the general Scholastic Attainment Test for College-Bound Seniors. The College Entrance Examination Center (CEEC) routinely computes summary statistics for different student subgroups across 5 subjects. The test scores for each subject run from 1 to 15. Suppose, for the year 2003, 59 out of a total of 164,521 participants received the maximum total score of 75. In addition, for Mathematics the median scores of students in the top 25%, the top 50%, all 100%, the bottom 50%, and the bottom 25% are: 10, 8, 5, 3, and 2, respectively.
  - a) Set up an approximate cumulative frequency distribution in a tabular form. (6 points)
  - b) Is the frequency distribution skewed to the right, skewed to the left, or symmetric? (2 points)
  - c) Give an interval where the middle half scores lie. (4 points)
2. IQ score is standardized to assume a normal distribution with a mean of 100 and a standard deviation of 15. Anastasia is a smart girl with an IQ score of 130. Her sister is so proud of her that she wants to make a bet with you. You two will choose a person randomly. If that person is smarter than Anastasia, you can win \$100 from Anastasia's sister. To make it a fair game, how much are you willing to pay her sister if that person is less clever than Anastasia? (13 points)
3. Find one variable, related to either TV industry, TV programs or TV viewing, for each of the four types of scales: ordinal, ratio, nominal, interval. (12 points)
4. A man wishes to open his door in the dark. He has five keys on his key ring and he tries them in his door at random (that is, it is possible that he tries the same key twice in succession). Only one of his keys will open the door. What is the probability that he opens the door on his third trial? (13 points)



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5. (25%) To test whether the mean time needed to mix a batch of chemicals is the same for machines produced by three manufacturers, the McKecek Pharmaceutical Company obtained the data shown below on the time (in minutes) needed to mix the chemicals. Using  $\alpha = .05$  and the data, test whether the population mean times for mixing a batch of chemicals differ for the three manufacturers.

| Manufacturer A | Manufacturer B | Manufacturer C |
|----------------|----------------|----------------|
| 19             | 26             | 26             |
| 22             | 24             | 31             |
| 23             | 20             | 28             |
| 20             | 22             | 27             |

6. (25%) The estimated regression equation based on 10 observations follows.

$$\hat{y} = 29.3468 + 5.6128 x_1 + 3.8344 x_2$$

Here  $SST = 7447.509$ ,  $SSR = 7373.952$ ,  $s_{b_1} = 0.2285$ , and  $s_{b_2} = 0.4332$ .

- (a) Perform the appropriate  $F$  test. Use  $\alpha = .05$ .  
 (b) Perform a  $t$  test for the significance of  $\beta_1$ . Use  $\alpha = .05$ .  
 (c) Perform a  $t$  test for the significance of  $\beta_2$ . Use  $\alpha = .05$ .

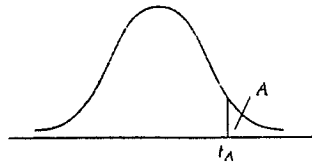


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Critical Values of  $t$ 

| DEGREES OF FREEDOM | $t_{.100}$ | $t_{.050}$ | $t_{.025}$ | $t_{.010}$ | $t_{.005}$ | DEGREES OF FREEDOM | $t_{.100}$ | $t_{.050}$ | $t_{.025}$ | $t_{.010}$ | $t_{.005}$ |
|--------------------|------------|------------|------------|------------|------------|--------------------|------------|------------|------------|------------|------------|
| 1                  | 3.078      | 6.314      | 12.706     | 31.821     | 63.657     | 24                 | 1.318      | 1.711      | 2.064      | 2.492      | 2.797      |
| 2                  | 1.886      | 2.920      | 4.303      | 6.965      | 9.925      | 25                 | 1.316      | 1.708      | 2.060      | 2.485      | 2.787      |
| 3                  | 1.638      | 2.353      | 3.182      | 4.541      | 5.841      | 26                 | 1.315      | 1.706      | 2.056      | 2.479      | 2.779      |
| 4                  | 1.533      | 2.132      | 2.776      | 3.747      | 4.604      | 27                 | 1.314      | 1.703      | 2.052      | 2.473      | 2.771      |
| 5                  | 1.476      | 2.015      | 2.571      | 3.365      | 4.032      | 28                 | 1.313      | 1.701      | 2.048      | 2.467      | 2.763      |
| 6                  | 1.440      | 1.943      | 2.447      | 3.143      | 3.707      | 29                 | 1.311      | 1.699      | 2.045      | 2.462      | 2.756      |
| 7                  | 1.415      | 1.895      | 2.365      | 2.998      | 3.499      | 30                 | 1.310      | 1.697      | 2.042      | 2.457      | 2.750      |
| 8                  | 1.397      | 1.860      | 2.306      | 2.896      | 3.355      | 35                 | 1.306      | 1.690      | 2.030      | 2.438      | 2.724      |
| 9                  | 1.383      | 1.833      | 2.262      | 2.821      | 3.250      | 40                 | 1.303      | 1.684      | 2.021      | 2.423      | 2.705      |
| 10                 | 1.372      | 1.812      | 2.228      | 2.764      | 3.169      | 45                 | 1.301      | 1.679      | 2.014      | 2.412      | 2.690      |
| 11                 | 1.363      | 1.796      | 2.201      | 2.718      | 3.106      | 50                 | 1.299      | 1.676      | 2.009      | 2.403      | 2.678      |
| 12                 | 1.356      | 1.782      | 2.179      | 2.681      | 3.055      | 60                 | 1.296      | 1.671      | 2.000      | 2.390      | 2.660      |
| 13                 | 1.350      | 1.771      | 2.160      | 2.650      | 3.012      | 70                 | 1.294      | 1.667      | 1.994      | 2.381      | 2.648      |
| 14                 | 1.345      | 1.761      | 2.145      | 2.624      | 2.977      | 80                 | 1.292      | 1.664      | 1.990      | 2.374      | 2.639      |
| 15                 | 1.341      | 1.753      | 2.131      | 2.602      | 2.947      | 90                 | 1.291      | 1.662      | 1.987      | 2.369      | 2.632      |
| 16                 | 1.337      | 1.746      | 2.120      | 2.583      | 2.921      | 100                | 1.290      | 1.660      | 1.984      | 2.364      | 2.626      |
| 17                 | 1.333      | 1.740      | 2.110      | 2.567      | 2.898      | 120                | 1.289      | 1.658      | 1.980      | 2.358      | 2.617      |
| 18                 | 1.330      | 1.734      | 2.101      | 2.552      | 2.878      | 140                | 1.288      | 1.656      | 1.977      | 2.353      | 2.611      |
| 19                 | 1.328      | 1.729      | 2.093      | 2.539      | 2.861      | 160                | 1.287      | 1.654      | 1.975      | 2.350      | 2.607      |
| 20                 | 1.325      | 1.725      | 2.086      | 2.528      | 2.845      | 180                | 1.286      | 1.653      | 1.973      | 2.347      | 2.603      |
| 21                 | 1.323      | 1.721      | 2.080      | 2.518      | 2.831      | 200                | 1.286      | 1.653      | 1.972      | 2.345      | 2.601      |
| 22                 | 1.321      | 1.717      | 2.074      | 2.508      | 2.819      | $\infty$           | 1.282      | 1.645      | 1.960      | 2.326      | 2.576      |
| 23                 | 1.319      | 1.714      | 2.069      | 2.500      | 2.807      |                    |            |            |            |            |            |



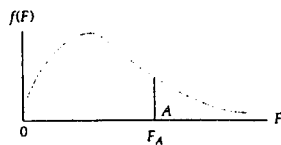
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科目：統計學

Percentage Points of the  $F$  Distribution,  $A = .05$



| $\nu_2 \backslash \nu_1$ | NUMERATOR DEGREES OF FREEDOM |       |       |       |       |       |       |       |       |
|--------------------------|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|                          | 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  | 2.27  |
| 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  |
| $\infty$                 | 3.84                         | 3.00  | 2.60  | 2.37  | 2.21  | 2.10  | 2.01  | 1.94  | 1.88  |



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Percentage Points of the  $F$  Distribution,  $A = .05$   
(Continued)

| $\nu_2$  | $\nu_1$ | NUMERATOR DEGREES OF FREEDOM |       |       |       |       |       |       |       |       |          |
|----------|---------|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|----------|
|          |         | 10                           | 12    | 15    | 20    | 24    | 30    | 40    | 60    | 120   | $\infty$ |
| 1        |         | 241.9                        | 243.9 | 245.9 | 248.0 | 249.1 | 250.1 | 251.1 | 252.2 | 253.3 | 254.3    |
| 2        |         | 19.40                        | 19.41 | 19.43 | 19.45 | 19.45 | 19.46 | 19.47 | 19.48 | 19.49 | 19.50    |
| 3        |         | 8.79                         | 8.74  | 8.70  | 8.66  | 8.64  | 8.62  | 8.59  | 8.57  | 8.55  | 8.53     |
| 4        |         | 5.96                         | 5.91  | 5.86  | 5.80  | 5.77  | 5.75  | 5.72  | 5.69  | 5.66  | 5.63     |
| 5        |         | 4.74                         | 4.68  | 4.62  | 4.56  | 4.53  | 4.50  | 4.46  | 4.43  | 4.40  | 4.36     |
| 6        |         | 4.06                         | 4.00  | 3.94  | 3.87  | 3.84  | 3.81  | 3.77  | 3.74  | 3.70  | 3.67     |
| 7        |         | 3.64                         | 3.57  | 3.51  | 3.44  | 3.41  | 3.38  | 3.34  | 3.30  | 3.27  | 3.23     |
| 8        |         | 3.35                         | 3.28  | 3.22  | 3.15  | 3.12  | 3.08  | 3.04  | 3.01  | 2.97  | 2.93     |
| 9        |         | 3.14                         | 3.07  | 3.01  | 2.94  | 2.90  | 2.86  | 2.83  | 2.79  | 2.75  | 2.71     |
| 10       |         | 2.98                         | 2.91  | 2.85  | 2.77  | 2.74  | 2.70  | 2.66  | 2.62  | 2.58  | 2.54     |
| 11       |         | 2.85                         | 2.79  | 2.72  | 2.65  | 2.61  | 2.57  | 2.53  | 2.49  | 2.45  | 2.40     |
| 12       |         | 2.75                         | 2.69  | 2.62  | 2.54  | 2.51  | 2.47  | 2.43  | 2.38  | 2.34  | 2.30     |
| 13       |         | 2.67                         | 2.60  | 2.53  | 2.46  | 2.42  | 2.38  | 2.34  | 2.30  | 2.25  | 2.21     |
| 14       |         | 2.60                         | 2.53  | 2.46  | 2.39  | 2.35  | 2.31  | 2.27  | 2.22  | 2.18  | 2.13     |
| 15       |         | 2.54                         | 2.48  | 2.40  | 2.33  | 2.29  | 2.25  | 2.20  | 2.16  | 2.11  | 2.07     |
| 16       |         | 2.49                         | 2.42  | 2.35  | 2.28  | 2.24  | 2.19  | 2.15  | 2.11  | 2.06  | 2.01     |
| 17       |         | 2.45                         | 2.38  | 2.31  | 2.23  | 2.19  | 2.15  | 2.10  | 2.06  | 2.01  | 1.96     |
| 18       |         | 2.41                         | 2.34  | 2.27  | 2.19  | 2.15  | 2.11  | 2.06  | 2.02  | 1.97  | 1.92     |
| 19       |         | 2.38                         | 2.31  | 2.23  | 2.16  | 2.11  | 2.07  | 2.03  | 1.98  | 1.93  | 1.88     |
| 20       |         | 2.35                         | 2.28  | 2.20  | 2.12  | 2.08  | 2.04  | 1.99  | 1.95  | 1.90  | 1.84     |
| 21       |         | 2.32                         | 2.25  | 2.18  | 2.10  | 2.05  | 2.01  | 1.96  | 1.92  | 1.87  | 1.81     |
| 22       |         | 2.30                         | 2.23  | 2.15  | 2.07  | 2.03  | 1.98  | 1.94  | 1.89  | 1.84  | 1.78     |
| 23       |         | 2.27                         | 2.20  | 2.13  | 2.05  | 2.01  | 1.96  | 1.91  | 1.86  | 1.81  | 1.76     |
| 24       |         | 2.25                         | 2.18  | 2.11  | 2.03  | 1.98  | 1.94  | 1.89  | 1.84  | 1.79  | 1.73     |
| 25       |         | 2.24                         | 2.16  | 2.09  | 2.01  | 1.96  | 1.92  | 1.87  | 1.82  | 1.77  | 1.71     |
| 26       |         | 2.22                         | 2.15  | 2.07  | 1.99  | 1.95  | 1.90  | 1.85  | 1.80  | 1.75  | 1.69     |
| 27       |         | 2.20                         | 2.13  | 2.06  | 1.97  | 1.93  | 1.88  | 1.84  | 1.79  | 1.73  | 1.67     |
| 28       |         | 2.19                         | 2.12  | 2.04  | 1.96  | 1.91  | 1.87  | 1.82  | 1.77  | 1.71  | 1.65     |
| 29       |         | 2.18                         | 2.10  | 2.03  | 1.94  | 1.90  | 1.85  | 1.81  | 1.75  | 1.70  | 1.64     |
| 30       |         | 2.16                         | 2.09  | 2.01  | 1.93  | 1.89  | 1.84  | 1.79  | 1.74  | 1.68  | 1.62     |
| 40       |         | 2.08                         | 2.00  | 1.92  | 1.84  | 1.79  | 1.74  | 1.69  | 1.64  | 1.58  | 1.51     |
| 60       |         | 1.99                         | 1.92  | 1.84  | 1.75  | 1.70  | 1.65  | 1.59  | 1.53  | 1.47  | 1.39     |
| 120      |         | 1.91                         | 1.83  | 1.75  | 1.66  | 1.61  | 1.55  | 1.50  | 1.43  | 1.35  | 1.25     |
| $\infty$ |         | 1.83                         | 1.75  | 1.67  | 1.57  | 1.52  | 1.46  | 1.39  | 1.32  | 1.22  | 1.00     |

