

等 別：三等考試  
 類 科：工業工程  
 科 目：工程統計學與品質管制  
 考試時間：2小時

座號：\_\_\_\_\_

※注意：(一)可以使用電子計算器。

(二)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。

(三)作答時請參考表一、表二。

- 一、某民意代表候選人聲稱支持他的比例多過支持另一位候選人的比例，因為根據其訪談 800 人次的結果，有 334 人支持他，306 人支持另一位候選人，其餘的沒有意見。請以統計檢定來檢查民意代表候選人的立論是否合宜。(15分)
- 二、一實驗有 A、B、C 等三個因子各有二水準，若 A×B 存在外，其餘交互作用均不存在，配置與實驗結果如下表。若其品質特性為望目特性，請分析決定最佳水準組合。(25分)

| No. | A | C | B | A×B |   |   |   | 觀測值  |       |      |      |
|-----|---|---|---|-----|---|---|---|------|-------|------|------|
|     | 1 | 2 | 3 | 4   | 5 | 6 | 7 |      |       |      |      |
| 1   | 1 | 1 | 1 | 1   | 1 | 1 | 1 | 4.15 | 21.87 | 3.95 | 3.80 |
| 2   | 1 | 1 | 1 | 2   | 2 | 2 | 2 | 4.13 | 18.41 | 4.13 | 3.33 |
| 3   | 1 | 2 | 2 | 1   | 1 | 2 | 2 | 3.15 | 14.37 | 2.97 | 2.02 |
| 4   | 1 | 2 | 2 | 2   | 2 | 1 | 1 | 2.99 | 19.29 | 2.63 | 2.64 |
| 5   | 2 | 1 | 2 | 1   | 2 | 1 | 2 | 4.22 | 9.04  | 7.84 | 4.07 |
| 6   | 2 | 1 | 2 | 2   | 1 | 2 | 1 | 5.74 | 23.41 | 6.53 | 6.38 |
| 7   | 2 | 2 | 1 | 1   | 2 | 2 | 1 | 4.72 | 22.23 | 5.35 | 5.35 |
| 8   | 2 | 2 | 1 | 2   | 1 | 1 | 2 | 3.27 | 18.44 | 4.07 | 3.12 |

- 三、若一單次抽樣檢驗為  $n = 20$ ， $A_c = 2$ ，請問產品不良率為 0.03 時，允收機率為多少？(10分)
- 四、某產品檢驗的瑕疵以缺點數 (c) 管制圖做管制，若依據過去的資料，其平均缺點數為 2.0。(一)請計算此 c 管制圖之管制界限。(10分)(二)若此工程段落檢驗的平均瑕疵為 4.0，請問有多少機率此產品檢驗瑕疵數會落在管制界限之外？(10分)
- 五、某機構調查其新開張的設施，將來訪的顧客分成四類，經收集八天的資料如下(單位：人次)：

| 顧客類別\天   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| 成年男性 (A) | 164 | 140 | 152 | 121 | 165 | 136 | 146 | 168 |
| 成年女性 (B) | 183 | 170 | 178 | 135 | 188 | 159 | 174 | 189 |
| 學生 (C)   | 122 | 110 | 108 | 100 | 140 | 124 | 154 | 150 |
| 幼童 (D)   | 111 | 96  | 106 | 88  | 135 | 97  | 114 | 109 |

請問：(一)各類顧客參訪人次是否有差異 ( $\alpha = 5\%$ )？(25分)

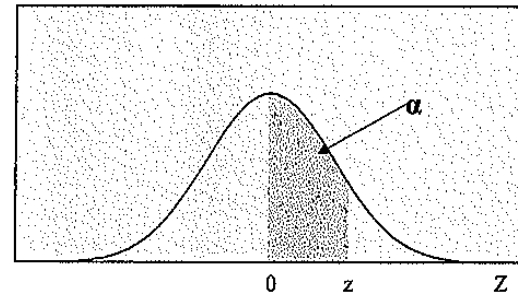
(二)以上的分析是基於何種條件？(5分)

(請接第二頁)

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表一 標準常態累加機率值表

$$P(0 < Z < z) = \alpha$$

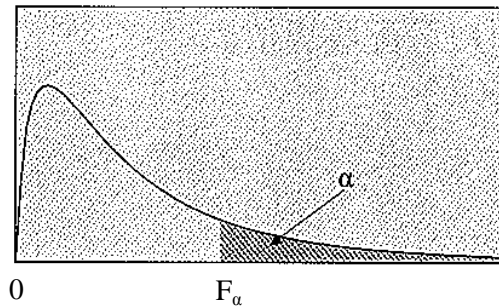


| z   | .00        | .01     | .02     | .03     | .04     | .05     | .06     | .07     | .08     | .09     |
|-----|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0.0 | 0.0000     | 0.0040  | 0.0080  | 0.0120  | 0.0160  | 0.0199  | 0.0239  | 0.0279  | 0.0319  | 0.0359  |
| 0.1 | 0.0398     | 0.0438  | 0.0478  | 0.0517  | 0.0557  | 0.0596  | 0.0636  | 0.0675  | 0.0714  | 0.0753  |
| 0.2 | 0.0793     | 0.0832  | 0.0871  | 0.0910  | 0.0948  | 0.0987  | 0.1026  | 0.1064  | 0.1103  | 0.1141  |
| 0.3 | 0.1179     | 0.1217  | 0.1255  | 0.1293  | 0.1331  | 0.1368  | 0.1406  | 0.1443  | 0.1480  | 0.1517  |
| 0.4 | 0.1554     | 0.1591  | 0.1628  | 0.1664  | 0.1700  | 0.1736  | 0.1772  | 0.1808  | 0.1844  | 0.1879  |
| 0.5 | 0.1915     | 0.1950  | 0.1985  | 0.2019  | 0.2054  | 0.2088  | 0.2123  | 0.2157  | 0.2190  | 0.2224  |
| 0.6 | 0.2257     | 0.2291  | 0.2324  | 0.2357  | 0.2389  | 0.2422  | 0.2454  | 0.2486  | 0.2517  | 0.2549  |
| 0.7 | 0.2580     | 0.2611  | 0.2642  | 0.2673  | 0.2704  | 0.2734  | 0.2764  | 0.2794  | 0.2823  | 0.2852  |
| 0.8 | 0.2881     | 0.2910  | 0.2939  | 0.2967  | 0.2995  | 0.3023  | 0.3051  | 0.3078  | 0.3106  | 0.3133  |
| 0.9 | 0.3159     | 0.3186  | 0.3212  | 0.3238  | 0.3264  | 0.3289  | 0.3315  | 0.3340  | 0.3365  | 0.3389  |
| 1.0 | 0.3413     | 0.3438  | 0.3461  | 0.3485  | 0.3508  | 0.3531  | 0.3554  | 0.3577  | 0.3599  | 0.3621  |
| 1.1 | 0.3643     | 0.3665  | 0.3686  | 0.3708  | 0.3729  | 0.3749  | 0.3770  | 0.3790  | 0.3810  | 0.3830  |
| 1.2 | 0.3849     | 0.3869  | 0.3888  | 0.3907  | 0.3925  | 0.3944  | 0.3962  | 0.3980  | 0.3997  | 0.4015  |
| 1.3 | 0.4032     | 0.4049  | 0.4066  | 0.4082  | 0.4099  | 0.4115  | 0.4131  | 0.4147  | 0.4162  | 0.4177  |
| 1.4 | 0.4192     | 0.4207  | 0.4222  | 0.4236  | 0.4251  | 0.4265  | 0.4279  | 0.4292  | 0.4306  | 0.4319  |
| 1.5 | 0.4332     | 0.4345  | 0.4357  | 0.4370  | 0.4382  | 0.4394  | 0.4406  | 0.4418  | 0.4429  | 0.4441  |
| 1.6 | 0.4452     | 0.4463  | 0.4474  | 0.4484  | 0.4495  | 0.4505  | 0.4515  | 0.4525  | 0.4535  | 0.4545  |
| 1.7 | 0.4554     | 0.4564  | 0.4573  | 0.4582  | 0.4591  | 0.4599  | 0.4608  | 0.4616  | 0.4625  | 0.4633  |
| 1.8 | 0.4641     | 0.4649  | 0.4656  | 0.4664  | 0.4671  | 0.4678  | 0.4686  | 0.4693  | 0.4699  | 0.4706  |
| 1.9 | 0.4713     | 0.4719  | 0.4726  | 0.4732  | 0.4738  | 0.4744  | 0.4750  | 0.4756  | 0.4761  | 0.4767  |
| 2.0 | 0.4772     | 0.4778  | 0.4783  | 0.4788  | 0.4793  | 0.4798  | 0.4803  | 0.4808  | 0.4812  | 0.4817  |
| 2.1 | 0.4821     | 0.4826  | 0.4830  | 0.4834  | 0.4838  | 0.4842  | 0.4846  | 0.4850  | 0.4854  | 0.4857  |
| 2.2 | 0.4861     | 0.4864  | 0.4868  | 0.4871  | 0.4875  | 0.4878  | 0.4881  | 0.4884  | 0.4887  | 0.4890  |
| 2.3 | 0.4893     | 0.4896  | 0.4898  | 0.4901  | 0.4904  | 0.4906  | 0.4909  | 0.4911  | 0.4913  | 0.4916  |
| 2.4 | 0.4918     | 0.4920  | 0.4922  | 0.4925  | 0.4927  | 0.4929  | 0.4931  | 0.4932  | 0.4934  | 0.4936  |
| 2.5 | 0.4938     | 0.4940  | 0.4941  | 0.4943  | 0.4945  | 0.4946  | 0.4948  | 0.4949  | 0.4951  | 0.4952  |
| 2.6 | 0.4953     | 0.4955  | 0.4956  | 0.4957  | 0.4959  | 0.4960  | 0.4961  | 0.4962  | 0.4963  | 0.4964  |
| 2.7 | 0.4965     | 0.4966  | 0.4967  | 0.4968  | 0.4969  | 0.4970  | 0.4971  | 0.4972  | 0.4973  | 0.4974  |
| 2.8 | 0.4974     | 0.4975  | 0.4976  | 0.4977  | 0.4977  | 0.4978  | 0.4979  | 0.4979  | 0.4980  | 0.4981  |
| 2.9 | 0.4981     | 0.4982  | 0.4982  | 0.4983  | 0.4984  | 0.4984  | 0.4985  | 0.4985  | 0.4986  | 0.4986  |
| 3.0 | 0.49865    | 0.49869 | 0.49874 | 0.49878 | 0.49882 | 0.49886 | 0.49889 | 0.49893 | 0.49897 | 0.49900 |
| 3.1 | 0.49903    | 0.49906 | 0.49910 | 0.49913 | 0.49916 | 0.49918 | 0.49921 | 0.49924 | 0.49926 | 0.49929 |
| 3.2 | 0.49931    | 0.49934 | 0.49936 | 0.49938 | 0.49940 | 0.49942 | 0.49944 | 0.49946 | 0.49948 | 0.49950 |
| 3.3 | 0.49952    | 0.49953 | 0.49955 | 0.49967 | 0.49958 | 0.49960 | 0.49961 | 0.49962 | 0.49964 | 0.49965 |
| 3.4 | 0.49966    | 0.49968 | 0.49969 | 0.49970 | 0.49971 | 0.49972 | 0.49973 | 0.49974 | 0.49975 | 0.49976 |
| 3.5 | 0.49977    | 0.49978 | 0.49978 | 0.49979 | 0.49980 | 0.49981 | 0.49981 | 0.49982 | 0.49983 | 0.49983 |
| 3.6 | 0.49984    | 0.49985 | 0.49985 | 0.49986 | 0.49986 | 0.49987 | 0.49987 | 0.49988 | 0.49988 | 0.49989 |
| 3.7 | 0.49989    | 0.49990 | 0.49990 | 0.49990 | 0.49991 | 0.49991 | 0.49992 | 0.49992 | 0.49992 | 0.49992 |
| 3.8 | 0.49993    | 0.49993 | 0.49993 | 0.49994 | 0.49994 | 0.49994 | 0.49994 | 0.49995 | 0.49995 | 0.49995 |
| 3.9 | 0.49995    | 0.49995 | 0.49996 | 0.49996 | 0.49996 | 0.49996 | 0.49996 | 0.49996 | 0.49997 | 0.49997 |
| 4.0 | 0.49996832 |         |         |         |         |         |         |         |         |         |
| 4.5 | 0.49999660 |         |         |         |         |         |         |         |         |         |
| 5.0 | 0.49999971 |         |         |         |         |         |         |         |         |         |
| 5.5 | 0.49999998 |         |         |         |         |         |         |         |         |         |
| 6.0 | 0.49999999 |         |         |         |         |         |         |         |         |         |

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表二  $F$  分配臨界值表

$$P(F > F_\alpha) = \alpha$$



| $v_2(d.f.)$ | $v_1(d.f.)$     |        |        |        |        |        |        |        |        |
|-------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|
|             | 1               | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      |
|             | $\alpha = 0.05$ |        |        |        |        |        |        |        |        |
| 1           | 161.45          | 199.50 | 215.71 | 224.58 | 230.16 | 233.99 | 236.77 | 238.88 | 240.54 |
| 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   | 2.18   | 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   |