國立臺灣科技大學
八十七學年度碩士班招生考試試題

所　別：管理技術研究所　　組別：甲組、乙組　　科目：統計學
學程別：企業管理學程

國立台灣科技大學企管學程碩士班入學考統計考題
（本考卷共有四頁，其中共有四題，每題25分，共100分）

第一題、台科公司爲進行財務預測，將其過去十年每年度之營業收入與營業成本率作迴歸分析。過去十年之資料如下：

| 樣本 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 年度 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 |
| $X$：營業收入(百萬元) | 58 | 91 | 61 | 72 | 52 | 67 | 90 | 62 | 95 | 83 |
| $Y$：營業成本率(%) | 37 | 31 | 43 | 39 | 41 | 39 | 35 | 40 | 29 | 33 |

該公司係使用線性迴歸(Linear Regression)，模型如下：

$$Y_t = \alpha + \beta X_t + \varepsilon_t \quad ; \ t = 1,\cdots,10$$

其中$\varepsilon_t$爲母體隨機殘差(Residual)。該公司以普通最小平方法(Ordinary Least Squares Method)進行係數估計，並以慣用之$t$檢定與$F$檢定進行各項假設檢定。其估計之迴歸方程式如下：

$$\hat{Y}_t = a + bX_t \quad ; \quad t = 1,\cdots,10$$

而樣本估計誤差爲：

$$e_t = Y_t - \hat{Y}_t$$

上述基本樣本資料經初步計算結果如下：

$$\sum_{t=1}^{10} X_t = 731 \ , \ \sum_{t=1}^{10} Y_t = 367 \ , \ \sum_{t=1}^{10} X_t^2 = 55601 \ , \ \sum_{t=1}^{10} Y_t^2 = 13657 \ , \ \sum_{t=1}^{10} X_t Y_t = 26267$$

下列問題爲複選題，各題均需完全答對，漏選正確答案均不予計分：

1、該公司在進行迴歸分析時，其基本假設爲何？(5分)
A：隨機殘差之期望值爲常數，亦即$E(\varepsilon_t) = \mu$
B：隨機殘差之變異數爲常數，亦即$Var(\varepsilon_t) = \sigma^2$
C：各期隨機殘差之間無相關，亦即$Cov(\varepsilon_t, \varepsilon_s) = 0 \ ; \ t \neq s$
D：隨機殘差與自變數之間需有相關，亦即$Cov(\varepsilon_t, X_t) \neq 0$
E：隨機殘差$\varepsilon_t$須服從常態分配
F：資料爲隨機樣本，各年度之營業收入$Y_t$之間無相關

2、關於迴歸分析之結果，下列何者正確？(10分)
A：迴歸方程式估計爲$\hat{Y}_t = 55.633 - 0.259X_t$
B：迴歸判定係數約爲$R^2 = 0.772$
C：應變數$Y$之變異有22.8%可被自變數$X$所解釋
D：$X$與$Y$之相關係數$r_{XY} = 0.879$

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所　別：管理技術研究所
學程別：企業管理學程
組別：甲組、乙組
科目：統計學

E：虛無假設 $H_0:\beta=0$ 在顯著水準 $\alpha=0.05$ 下無法被拒絕，表示營業收入與營業成本率無顯著關係

F：迴歸變異數估計約為 $\hat{\sigma}^2=5.36$

3、該公司以其估計之迴歸方程式進行預測，下列敘述何者正確？(10 分)

A：若 87 年度之營業收入預測為 $X_0=100$，則 87 年度之營業成本率應可合理估計為 $\hat{Y}_0=29.733$

B：若 87 年度之營業收入預測為 $X_0=100$，則 87 年度之營業成本率之 95% 信賴區間估計為 $29.733-t_{8,0.025}\sqrt{7.688}\le Y_0\le 29.733+t_{8,0.025}\sqrt{7.688}$

C：若預測某年度之營業收入為 $X_0=214.8$，則該年度之營業成本率可估計為 $\hat{Y}_0=0$，此估計在實際應用上應屬合理

D：若 87 年度之營業收入預測為 $X_0=100$，則 87 年度之期望營業成本率之 95%信賴區間估計為 $29.733-t_{8,0.025}\sqrt{12.1}\le E(Y/X_0)\le 29.733+t_{8,0.025}\sqrt{12.1}$

E：若營業收入預測值 $X_0$ 距離其平均值 $\overline{X}$ 愈遠，則營業成本率估計值 $\hat{Y}_0$ 之估計誤差將愈大，表示估計愈不可靠

F：若預測點不在樣本觀察值範圍之內，則可能發生模型改變之危險，使預測價值降低

第二題、由以往記錄可知台灣科技公司第一工廠第十號研磨機所製造產品之缺點平均數為 20%。現隨機選取 10 個產品，試問下列諸題之機率為何：(a) 恰有兩個缺點(10 分)，(b)兩個及兩個以上缺點(15 分)。

第三題、Two statistics teachers, Mr. Chan and Mr Huang argue about their abilities at golf. Mr. Chan claims that with a number 7 iron he can hit the ball, on average, at least 10m further than Mr. Huang. Denoting the distance Mr. Chan hits the ball by (100+c) meters, the following results were obtained: $n_1$=40 , $\sum c$=80 , $\sum(c-\bar{c})^2$=1132. Denoting the distance Mr Huang hits the ball by (100+t) meters, the following results were obtained: $n_2$=35 , $\sum t$ = -175 , $\sum(t-\bar{t})^2$=1197. If the distances for both teachers are normally distributed with a common variance, (1) what is an unbiased estimate of this common variance? (2) test whether there is any evidence, at the 1% level, to support Mr. Chan's claim. (3) find the type II error if Mr. Chan can hit the ball, in fact, 5m further than Mr. Huang.

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所　別：管理技術研究所
學程別：企業管理學程
組別：甲組、乙組
科目：統計學

第四題、The mid-term scores of a statistics class are listed below: (25 points)

| Major | Rank | Student ID No. | Name | Score |
|---|---|---|---|---|
| Finance | Freshman | 248679856 | John Smith | 83 |
| Marketing | Junior | 297854689 | Alex Chang | 90 |
| Accounting | Freshman | 358497684 | Amy Baldwin | 89 |
| Finance | Freshman | 468579278 | Robert Irwin | 64 |
| History | Sophomore | 576548526 | Michael Copper | 62 |
| Accounting | Freshman | 578924568 | Louis Turner | 77 |
| Finance | Sophomore | 708493864 | Tammy Long | 57 |
| Finance | Freshman | 758849631 | Jenny Gere | 93 |
| Marketing | Freshman | 839457856 | Lucy Williams | 41 |
| Marketing | Sophomore | 894682269 | Christine Hunt | 85 |
| Economics | Junior | 997846842 | Tom Chen | 96 |

Two samples were drawn using one of the following sampling methods: cluster sampling, simple random sampling with replacement, simple random sampling without replacement, stratified sampling, systematic sampling. The sample results are:

Sample A = {89, 96, 64, 93, 62, 41}
Sample B = {96, 93, 62, 90}

1) Which sampling method(s) might be used to draw Sample A? Explain why do you think so?
2) Repeat part 1) for Sample B.

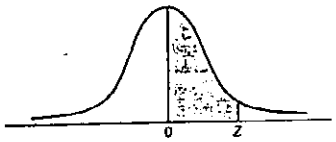
# 國立臺灣科技大學
## 八十七學年度碩士班招生考試試題

所　別：管理技術研究所
學程別：企業管理學程

組別：甲組、乙組

科目：統計學

### 附表　一.標準常態分配表




表內的數值表示標準常態分配下從平均數到Z值的面積

| Z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0279 | .0319 | .0359 |
| 0.1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0753 |
| 0.2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 |
| 0.3 | .1179 | .1217 | .1255 | .1293 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 |
| 0.4 | .1554 | .1591 | .1628 | .1664 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 |
| 0.5 | .1915 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 |
| 0.6 | .2257 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2518 | .2549 |
| 0.7 | .2580 | .2612 | .2642 | .2673 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 |
| 0.8 | .2881 | .2910 | .2939 | .2967 | .2995 | .3023 | .3051 | .3078 | .3106 | .3133 |
| 0.9 | .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 | .49865 | .49869 | .49874 | .49878 | .49882 | .49886 | .49889 | .49893 | .49897 | .49900 |
| 3.1 | .49903 | .49906 | .49910 | .49913 | .49916 | .49918 | .49921 | .49924 | .49926 | .49929 |
| 3.2 | .49931 | .49934 | .49936 | .49938 | .49940 | .49942 | .49944 | .49946 | .49948 | .49950 |
| 3.3 | .49952 | .49953 | .49955 | .49957 | .49958 | .49960 | .49961 | .49962 | .49964 | .49965 |
| 3.4 | .49966 | .49968 | .49969 | .49970 | .49971 | .49972 | .49973 | .49974 | .49975 | .49976 |
| 3.5 | .49977 | .49978 | .49978 | .49979 | .49980 | .49981 | .49981 | .49982 | .49983 | .49983 |
| 3.6 | .49984 | .49985 | .49985 | .49986 | .49986 | .49987 | .49987 | .49988 | .49988 | .49989 |
| 3.7 | .49989 | .49990 | .49990 | .49990 | .49991 | .49991 | .49992 | .49992 | .49992 | .49992 |
| 3.8 | .49993 | .49993 | .49993 | .49994 | .49994 | .49994 | .49994 | .49995 | .49995 | .49995 |
| 3.9 | .49995 | .49995 | .49996 | .49996 | .49996 | .49996 | .49996 | .49996 | .49997 | .49997 |