# 國立中央大學104學年度碩士班考試入學試題

所別：營建管理研究所碩士班 不分組(一般生)　科目：工程經濟與統計　共 2 頁 第 1 頁

本科考試可使用計算器，廠牌、功能不拘　＊請在答案卷（卡）內作答

## I. 工程統計（50 分）

一、某工程師測試 40 個焊接點的相對強度，所得結果如下表所示。

(1) 請計算測試結果之平均值、眾數、中位數與標準差。(8 分)

(2) 請繪製(1)次數分配表(表中需包括組下限、組上限、組中值、次數、相對次數百分比、累積相對次數百分比)、(2)直方圖、與(3)累積次數分配圖。(次數分配表 5 分，直方圖與累積次數分配圖各 4 分，共 13 分)

(3) 相對強度在 2.8 以下的機率大約為何？相對強度在 0.8~2.3 之間的機率大約為何？(各 2 分，共 4 分)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.5 | 1.2 | 3.1 | 1.3 | 0.7 | 1.3 | 1.8 | 2.9 |
| 0.1 | 2.9 | 1.0 | 1.3 | 2.6 | 1.7 | 2.3 | 2.2 |
| 0.3 | 0.7 | 2.4 | 1.5 | 0.7 | 2.1 | 3.3 | 1.2 |
| 3.5 | 1.1 | 0.7 | 0.5 | 1.6 | 1.4 | 3.1 | 1.3 |
| 1.7 | 3.2 | 3.0 | 1.7 | 2.8 | 2.2 | 3.3 | 1.4 |

二、某瀝青混凝土路面工程，按規定每 1,000m 為一檢驗批次，而每批次應抽驗五點之厚度。某批之起點樁號為 12K+000(接續樁之樁號為 12K+001、12K+002、……、12K+999，直至 13K+000 為 1,000m)，請從下列之隨機亂數表第一行、第一列之 1 開始，依序以簡單隨機抽樣、分層隨機抽樣、系統抽樣決定檢驗位置之樁號(各抽樣方法接續自亂數表取亂數)(15 分)。

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 19223 | 95034 | 05756 | 28713 | 96409 | 12531 | 42544 | 82853 | 73676 | 47150 | 99400 |
| 01927 | 27754 | 42648 | 82425 | 36290 | 45467 | 71709 | 77558 | 00095 | 32863 | 29485 |
| 82226 | 90056 | 52711 | 38889 | 93074 | 60227 | 40011 | 85848 | 48767 | 52573 | 95592 |
| 94007 | 69971 | 91481 | 60779 | 53791 | 17297 | 59335 | 68417 | 35013 | 15529 | 72765 |

三、下表為所量測而得之瓦斯壓力(公斤/平方公分)與其體積(公升)之數據資料。請問：(1)可使用哪一統計技術分析此資料？(2)請應用此技術決定壓力與體積之關係。(10 分)

| 壓力 | 0.5 | 1.5 | 2.0 | 3.0 | 2.5 | 1.0 | 0.8 | 1.2 | 2.8 | 3.2 | 1.8 | 0.3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 體積 | 1.62 | 0.75 | 1.62 | 0.46 | 0.52 | 1.00 | 1.35 | 0.89 | 0.48 | 0.43 | 0.71 | 1.80 |

注意：背面有試題

## II. 工程經濟 (50 分)

Oil price keeps falling. You own a small business, which is directly proportional to 95 unleaded petrol price, and want to make some adjustments for your business. You collected the monthly average price of 95 unleaded petrol and the monthly Customer Price Index (CPI) for the last 6 months in 2014 shown in the table. Given that your annual minimum attractive rate of return (MARR) before tax ($i_c$) is set to 12%, petrol price change rate is considered as the total price escalation rate ($e$), the CPI change rate is regarded as general price inflation rate ($f$), the base is set to July of 2014, **please answer the questions:**

Table: 95-unlead petrol monthly average price and CPI for 2014

| Month | July | August | September | October | November | December |
|---|---|---|---|---|---|---|
| Price ($) | 35.21 | 34.45 | 33.5 | 32.38 | 30.51 | 27.99 |
| CPI | 107.7 | 108 | 108.3 | 108.7 | 108 | 108.7 |

1) Based on the definitions of the price inflation and total price escalation, please find the $f$ and $e$ for the last 6 month in 2014 (24 pt).
2) For the last 6 months in 2014, determine monthly inflation-free MARR ($i_r$) (6 pt) and the differential price inflation rates ($e'$) (6 pt) for each month.
3) Due to the influence by inflation, Determine the semiannual effective rate of inflation ($\bar{f}$) (6 pt).
4) Make adjustment for your annual MARR based on the results from (3) (8 pt).

**To find Present value given Future value (P/F) at the first 10 years, discount rate:

| | i=1% | i=2% | i=3% | i=4% | i=5% | i=6% | i=8% | i=10% | i=12% |
|---|---|---|---|---|---|---|---|---|---|
| Period 1 | .9901 | .9804 | .9709 | .9615 | .9524 | .9434 | .9259 | .9091 | .8929 |
| Period 2 | .9803 | .9612 | .9426 | .9246 | .9070 | .8900 | .8573 | .8264 | .7972 |
| Period 3 | .9706 | .9423 | .9151 | .8890 | .8638 | .8396 | .7938 | .7513 | .7118 |
| Period 4 | .9610 | .9238 | .8885 | .8548 | .8227 | .7921 | .7350 | .6830 | .6355 |
| Period 5 | .9515 | .9057 | .8626 | .8219 | .7835 | .7473 | .6806 | .6209 | .5674 |
| Period 6 | .9420 | .8880 | .8375 | .7903 | .7462 | .7050 | .6302 | .5645 | .5066 |
| Period 7 | .9327 | .8706 | .8131 | .7599 | .7107 | .6651 | .5835 | .5132 | .4523 |
| Period 8 | .9235 | .8535 | .7894 | .7307 | .6768 | .6274 | .5403 | .4665 | .4039 |
| Period 9 | .9143 | .8368 | .7664 | .7026 | .6446 | .5919 | .5002 | .4241 | .3606 |
| Period 10 | .9053 | .8203 | .7441 | .6756 | .6139 | .5584 | .4632 | .3855 | .3220 |

**To find Present value given Annuity (P/A) at the first 10 years discount rate:

| | i=1% | i=2% | i=3% | i=4% | i=5% | i=6% | i=8% | i=10% | i=12% |
|---|---|---|---|---|---|---|---|---|---|
| Period 1 | 0.9901 | 0.9804 | 0.9709 | 0.9615 | 0.9524 | 0.9434 | 0.9259 | 0.9091 | 0.8929 |
| Period 2 | 1.9704 | 1.9416 | 1.9135 | 1.8861 | 1.8594 | 1.8334 | 1.7833 | 1.7355 | 1.6901 |
| Period 3 | 2.9410 | 2.8839 | 2.8286 | 2.7751 | 2.7232 | 2.6730 | 2.5771 | 2.4869 | 2.4018 |
| Period 4 | 3.9020 | 3.8077 | 3.7171 | 3.6299 | 3.5460 | 3.4651 | 3.3121 | 3.1699 | 3.0373 |
| Period 5 | 4.8534 | 4.7135 | 4.5797 | 4.4518 | 4.3295 | 4.2124 | 3.9927 | 3.7908 | 3.6048 |
| Period 6 | 5.7955 | 5.6014 | 5.4172 | 5.2421 | 5.0757 | 4.9173 | 4.6229 | 4.3553 | 4.1114 |
| Period 7 | 6.7282 | 6.4720 | 6.2303 | 6.0021 | 5.7864 | 5.5824 | 5.2064 | 4.8684 | 4.5638 |
| Period 8 | 7.6517 | 7.3255 | 7.0197 | 6.7327 | 6.4632 | 6.2098 | 5.7466 | 5.3349 | 4.9676 |
| Period 9 | 8.5660 | 8.1622 | 7.7861 | 7.4353 | 7.1078 | 6.8017 | 6.2469 | 5.7590 | 5.3282 |
| Period 10 | 9.4713 | 8.9826 | 8.5302 | 8.1109 | 7.7217 | 7.3601 | 6.7101 | 6.1446 | 5.6502 |

參考用

注意：背面有試題