所別：企業管理學系碩士班 一般甲組(一般生)　　科目：統計學　共 **2** 頁 第 **1** 頁
　　　企業管理學系碩士班 一般乙組(一般生)
　　　企業管理學系碩士班 一般丁組(一般生)
　　　企業管理學系碩士班 一般戊組(一般生)

本科考試禁用計算器　　　　　　　　　　　　　　　　　＊請在答案卷（卡）內作答

**I. Please select one best answer in the following choice questions and fill in answers in the answer card. (48%)**

1. (6%) If $X$ and $Y$ are two independent random variables, $X$ and $Y$ have zero covariance.

   (A) True (B) False.

2. (6%) If two random variables $X$ and $Y$ have zero covariance, $X$ and $Y$ are independent.

   (A) True (B) False.

3. (6%) Figure 1 gives four different probability density plots. Which one is most likely from a normal distribution?
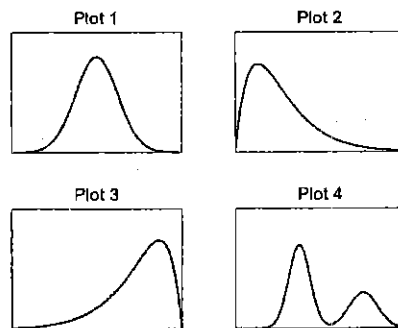
   (A) Plot 1 (B) Plot 2 (C) Plot 3 (D) Plot 4.



Figure 1: Probability density plots

4. (6%) In Figure 1, the distribution that produces Plot 2 is

   (A) Symmetric (B) Skewed to the right (C) Skewed to the left (D) Bimodal.

5. (6%) If a random variable has mode = 4, median = 3.4, and mean = 2, it is most likely that this random variable is

   (A) Symmetric (B) Skewed to the right (C) Skewed to the left (D) Bimodal.

6. (6%) A Type I error is rejecting a true null hypothesis.

   (A) True (B) False.

7. (6%) Let $X$ be a binomial distribution with parameters $N$ and probability $p$. Which of the following transformation of $X$ is approximately a standard normal distribution when $N$ becomes large?

   (A) $\frac{X-Np}{\sqrt{p(1-p)}}$ (B) $\frac{X-p}{\sqrt{p(1-p)}}$ (C) $\frac{X-p}{\sqrt{Np(1-p)}}$ (D) $\frac{X-Np}{\sqrt{Np(1-p)}}$.

8. (6%) A city bus has a capacity of 36 people. The weights of the passengers have a distribution with a mean of 50 kilograms and a standard deviation of 5 kilograms. If the bus is full, what is the chance that the total weight in the bus is larger than 1890 kilograms?

   (A) 0.8413 (B) 0.1587 (C) 0.0228 (D) 0.0013.

   Hint: Let $\Phi(\cdot)$ be the cumulative distribution function of the standard normal distribution. $\Phi(-1) = 0.1587$, $\Phi(-2) = 0.0228$, and $\Phi(-3) = 0.0013$.

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注意：背面有試題

國立中央大學104學年度碩士班考試入學試題

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**II. Please write down your answers in the answer sheet (52%).**

1. (27%) The following table gives information on ages and cholesterol levels for a random sample of 10 men

| Age | 58 | 69 | 43 | 39 | 63 | 52 | 47 | 31 | 74 | 36 |
|-----|----|----|----|----|----|----|----|----|----|----|
| Cholesterol level | 189 | 235 | 193 | 177 | 154 | 191 | 213 | 165 | 198 | 181 |

Take age as an independent variable ($x$) and cholesterol level ($y$) as a dependent variable and consider a linear regression. It is known $n = 10$, $\bar{x} = \sum x/n = 51.2$, $\bar{y} = \sum y/n = 189.6$, $\sum x^2 = 28110$, $\sum y^2 = 364280$, $\sum xy = 98307$, $SS_{xx} = \sum x^2 - n\bar{x}^2 = 1895.6$, $SS_{yy} = \sum y^2 - n\bar{y}^2 = 4798.4$, and $SS_{xy} = \sum xy - n\bar{x}\bar{y} = 1231.8$.

(a) (7%) Find the regression of cholesterol level on age.

(b) (5%) Plot the scatter diagram and the regression line.

(c) (5%) Predict the cholesterol level of a 60-year-old man.

(d) (5%) Construct a 95% confident interval for the slop $b$ of the regression in (b).

(e) (5%) Is the slop $b$ positive or not? Why or why not?

2. (25%) A group of 29 employees has recently been hired. The training director randomly assigns 15 of them to the traditional training method and the rest (14) to the new team-based training. When the training period is completed, she evaluates the employees on the time it takes them to assemble a product. Here are the data and some summary statistics:

Assembly Times in minutes

| Individual Training | 9.2, 9.6, 9.1, 9.1, 9.0, 9.1, 9.3, 9.7, |
| | 9.2, 8.4, 9.5, 8.9, 8.7, 9.3, 8.8 |
| Team Training | 8.5, 8.4, 8.8, 8.6, 8.8, 9.7, 8.7, |
| | 9.0, 8.2, 9.5, 8.8, 8.9, 8.5, 8.7 |

| | N | Mean | StDev | SE Mean |
|---|---|------|-------|---------|
| Individual training | 15 | 9.127 | 0.343 | 0.089 |
| Team training | 14 | 8.793 | 0.403 | 0.110 |

The direct suspects that the team training yields reduced assembly times. To answer this question, please implement the following statistical hypothesis test. Let $n_1 = 15$, $n_2 = 14$, $s_1 = 0.343$, $s_2 = 0.403$. It is known $\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} = 0.0194$, $\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = 0.1394$, $\frac{s_1^2/2}{s_1^2/n_1 + s_2^2/n_2} = 0.4$, $\frac{0.4^2}{14} + \frac{(1-0.4)^2}{13} = 0.03912$.

(a) (5%) Write down the null hypothesis and the alternative hypothesis.

(b) (10%) Calculate the statistics for implementing the hypothesis testing.

(c) (10%) Choosing a significant level of 5%. What is your conclusion?

Table 1: The following table gives quantile $q$ so that $Prob(t_\nu > q) = \alpha$, where $t_\nu$ is the Student-$t$ distribution of degree of freedom $\nu$.

| $\nu$ | 4 | 8 | 24 | 25 | 26 | 27 |
|-------|----|----|-----|-----|-----|-----|
| $\alpha$ | | | | | | |
| 0.025 | 2.78 | 2.31 | 2.06 | 2.06 | 2.06 | 2.05 |
| 0.05 | 2.13 | 1.86 | 1.71 | 1.71 | 1.71 | 1.70 |
| 0.1 | 1.53 | 1.40 | 1.32 | 1.32 | 1.31 | 1.31 |

注意：背面有試題