編號： 287

# 國立成功大學 106 學年度碩士班招生考試試題

系　　所：電信管理研究所

考試科目：統計學

考試日期：0214，節次：2



※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (20%) Suppose that 45 percent of the population favors a certain candidate in an upcoming election. If a random sample of size 200 is chosen, find

(a) the expected value and standard deviation of the number of members of the sample that favor the candidate;

(b) the probability that more than half the members of the sample favor the candidate (Please list your calculation based on the normal approximation).

2. (20%) Suppose $X_1,\ldots,X_n$ are independent, normal random variables each with unknown mean $\mu$ and unknown standard deviation $\sigma$. The joint density is given by

$$f(x_1,\ldots,x_n|\mu,\sigma)=\prod_{i=1}^{n}\frac{1}{\sqrt{2\pi}\sigma}\exp\left[\frac{-(x_i-\mu)^2}{2\sigma^2}\right]$$

(a) Please derive its logarithm of the likelihood.

(b) Find the value of $\mu$ and $\sigma$ maximizing the above logarithm of the likelihood.

3. (20%) There are 250 families in Scandia, Pennsylvania. A poll of 40 families reveals the mean monthly cell phone bill is \$450 with a standard deviation of \$75. Construct a 90 percent confident interval for the mean monthly expense on using cell phone. Please list your calculation. The $z$ value for a 90 (95) percent level of confidence is 1.65 (1.96).

4. (20%) A student in telecommunication management wants to determine how much do consumers spend on cellphone apps and games on average per year. The error in estimating the mean is to be less that \$100 with a 99 percent level of confidence. The student found a report by National Communications Commission (NCC) that estimated the standard deviation to be \$1,000. What is the required sample size? The $z$ value for a 95 (99) percent level of confidence is 1.96 (2.58).

5. (20%) In the table below, the $x_i$ column shows scores on the aptitude test. Similarly, the $y_i$ column shows statistics grades.

(a) Please calculate the least squares regression line.

(b) If a student made an 80 on the aptitude test, the estimated statistics grade would be?

| Student | $x_i$ | $y_i$ | $(x_i - x)$ | $(y_i - y)$ | $(x_i - x)^2$ | $(y_i - y)^2$ | $(x_i - x)(y_i - y)$ |
|---|---|---|---|---|---|---|---|
| 1 | 95 | 85 | 17 | 8 | 289 | 64 | 136 |
| 2 | 85 | 95 | 7 | 18 | 49 | 324 | 126 |
| 3 | 80 | 70 | 2 | -7 | 4 | 49 | -14 |
| 4 | 70 | 65 | -8 | -12 | 64 | 144 | 96 |
| 5 | 60 | 70 | -18 | -7 | 324 | 49 | 126 |