考 試 科 目 統計學　所 別 財政2431　考 試 時 間 3 月 16 日 星期 日 第四 節

1. (10 points) Answer True or False; if false, correct it.

(1) A and B are mutually exclusive if $\Pr(A \text{ and } B) = \Pr(A)\Pr(B)$.

(2) If a fair coin has been fairly tossed 5 times and has come up tails each time, on the sixth toss the conditional probability of tails will be $1/64$.

2. (10 points) When is it true, or approximately true, that: （什麼時候以下等式會成立或大約成立？）

(1) $E(X^2) = [E(X)]^2$?　　(2) $E(XY) = E(X)E(Y)$?

3. (10 points) Suppose X and Y have the following joint distribution:

	Y		
X	0	2	4
0	0.1	0.1	0
2	0.1	0.4	0.1
4	0	0.1	0.1

Find the following expected values:

(1) $E(X^2 + Y^2)$　　(2) $E(X-2)(Y-2)$

4. When S successes occur in n trials, the sample proportion $P = S/n$ customarily is used as an estimator of the probability of success π. However, sometimes there are good reasons to use another estimator P^*. Alternatively, P^* can be written as a linear combination of the familiar estimator P:

$$P^* = (S+1)/(n+2) = [n/(n+2)]P + [1/(n+2)],$$

(1) (10 points) What is the Mean Square Error (MSE) of P?　Is it consistent?

(2) (10 points) What is the Mean Square Error (MSE) of P^*?　Is it consistent?

(3) (5 points) State some possible circumstances when you might prefer to use P^* instead of P to estimate π.

5. (15 points) Consider the problem facing an air traffic controller at Chicago's Airport. If a small irregular dot appears on the screen, approaching the flight path of a large jet, she must decide between:

H_0: All is well.　It's only a bit of interference on the screen.

H_A: A collision with a small private plane is imminent.

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Question 5 is continued.   Answer True or False; if false, correct it.

Satement: [If H_0 is true, a "false alarm" could occur, called a type II error.   If H_A is true, a "missed alarm" could occur, called a type I error.   By making the equipment more sensitive and reliable, it is possible to reduce the type I error only.]

6. A group of 4 physicians （醫生）hired a management consultant to see whether he could reduce the long waiting times of their patients （病患）. He randomly sampled 200 patients, and found their waiting times had an average of 32 minutes, and a standard deviation of 15 minutes.   To determine the factors that influence waiting time, he ran a multiple regression:

$WAIT = a + b * DRLATE + c * PALATE + d * SHORT + \varepsilon$,

where $WAIT$ = waiting time (in minutes), $DRLATE$ = the lateness of the doctors in arriving that morning (sum of their times, in minutes), $PALATE$ = the lateness of the patient in arriving for his appointment (in minutes), $SHORT$ = 1 if the clinic （診所）was short staffed （醫師人力不足，有人休假）, and some of the appointments had to be rebooked （重新預約）; 0 if fully staffed with all 4 physicians （四位醫師全部到齊）, ε is the error term.

The regression results are shown in the following table:

Variables	Coefficients	Standard Error
Constant	22	
$DRLATE$	0.09	0.01
$PALATE$	-0.24	0.05
$SHORT$	2.61	0.82
R^2	0.72	

(1)   Answer True or False; if False, correct it:

(a). (5 points) Since the coefficient of $SHORT$ is biggest, it is the most important factor in accounting for the variation in $WAIT$.

(b). (5 points) If he included another factor in the multiple regression, R^2 would necessarily be larger, as would the corrected (adjusted) $\bar{R}^2$.

(2) (15 points) For each of the three coefficients （b, c, d）, calculate the 95% confidence intervals, and t ratios.

(3) (5 points) At the 5% significance level, would $DRLATE$, $PALATE$, and $SHORT$ be statistically discernible (significant) factors?