國立嘉義大學九十七學年度
資訊管理學系碩士班（甲組）招生考試試題

科目：統計學

1. (15%) The Boston South Fifth Street Softball League consists of three terms: Mama's Boys, team 1; the Killers, term 2; and the Machos, team 3. Each team plays the other teams just once during the season. The win-loss record for the past five years is as follows:

Winner	(1)	(2)	(3)
Mama's Boys (1)	X	3	4
the Killers (2)	2	X	1
the Machos (3)	1	4	X

Each row represents the number of wins over the past five years. Mama's Boys beat the Killers 3 times, beat the Machos 4 times, and so on.

(a) What is the probability that the Killers will win every game next year?

(b) What is the probability that the Machos will at least one game next year?

The schedule for the Killers next year is as follows:

Game 1: The Machos

Game 2: Mama's Boys

(c) What is the probability that the Killers will break even—win exactly one game?

(d) What is the probability that the Killers will win every game?

(e) What is the probability that the Killers will lose every game?

2. (10%) Patients arrive at the emergency room of Costa Valley Hospital at an average of 5 per day. The demand for emergency room treatment at Costa Valley follows a Poisson distribution.

(a) Compute the probability of exactly 0, 1, 2, 3, 4, and 5 arrivals per day (e^{-5}=0.0067).

(b) What is the sum of these probabilities, and why is the number less than 1.

3. (10%) A study of nonfatal occupational injuries in the U.S. found that about 31% of all injuries in the service sector involved the back. The National Institute for Occupational Safety and Health (NIOSH) recommended conducting comprehensive ergonomics assessment of jobs and workstations. In response to this information, Mark Glassmeyer developed a unique ergonomic handcart to help field service engineers be more productive and also to reduce back injuries from lifting parts and equipment during service calls. Using a sample of 382 field service engineers who were provided with these carts, Mark collected the following data:

	Year 1 (without cart)	Year 2 (with cart)
Average call time	8.05 hours	7.84 hours
Standard deviation call time	1.39 hours	1.34 hours
Proportion of back injuries	0.018	0.01

(a) Develop a 95% confidence interval on the average call time for each year ($z_{\alpha/2}$=1.96, $\sqrt{382}=19.54$).

(b) Find 95 percent confidence intervals for the difference in average call times ($z_{\alpha/2}$=1.96) and difference in proportion of back injuries (just show the formula).

4. (15%) In testing battery drain in model racing cars, two students obtained the following results for discharge time in minutes:

	Factor 2: Connection Type	
Factor 1: Battery Type	Gold-Plated	Standard
High Cost	493	489
High Cost	496	482
Low Cost	96	84
Low Cost	94	93

Conduct an analysis of variance for this factorial experiment to determine the significance of interaction and main effects as appropriate. Part of the percentage points for F distribution is shown as follows:

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5. (10%) The managing director of a consulting group has the following monthly data on total overhead costs and professional labor-hours to bill to clients.

Total Overhead Costs	Billable Hours
$340,000	3,000
$400,000	4,000
$435,000	5,000
$477,000	6,000
$529,000	7,000
$587,000	8,000

Generate a regression model to identify the fixed overhead costs to the consulting group.

(a) What is the constant component of the consultant group's overhead?

(b) If a special job requiring 1,000 billable hours that would contribute a margin of $38,000 before overhead was available, would the job be attractive?

背面尚有試題

6. (15%) The mean and standard deviation of the following lamp lifetime sample are 1650 and 100, respectively. Is the sample drawn from a normal population (Use α = 0.05)? Show how your answer is obtained.

Frequency distribution of sample

Group (lifetime in hours)	Number of lamps
1. 1400 up to 1500	10
2. 1500 up to 1600	50
3. 1600 up to 1700	70
4. 1700 up to 1800	50
5. 1800 up to 1900	20
Total	200

(Note: $\chi^2_{0.025,4} = 11.14$, $\chi^2_{0.05,4} = 9.488$, $\chi^2_{0.1,4} = 7.779$, $\chi^2_{0.025,5} = 12.83$, $\chi^2_{0.05,5} = 11.07$, $\chi^2_{0.1,5} = 9.236$)

7. (15%) Suppose the moment-generating function (m.g.f) of random variable X is $e^{2(e^t-1)}$ with $-\infty < t < \infty$. Find：
   (a) the probability mass function of X.
   (b) the mean and variance of X.

8. (10%) A joint probability mass function f(x, y)=$\frac{1}{4}$ with (x, y) =(1,0), (0,1), (1,2), (2,1).
   (a) Find $\rho_{x\,y}$.
   (b) Are x and y independent? Explain.