CITY UNIVERSITY OF HONG KONG

Department of Management Sciences

Course code & title	:	CB2200 Business Statistics
Session	:	Semester B, 2019-2020
Time allowed	:	Two hours

Name: _____ Student Number: _____

Instructions to students:

- Write down your name and student number in the spaces provided. If you write or type the answers on separate papers, please write down your name and student number on the first page of the answer scripts.
- This paper has 11 pages (including this page).
- This paper consists of 6 questions. Answer all questions.
- Write your answers in the spaces provided. If you write or type the answers on separate papers, please indicate the question number clearly. Convert the answer scripts into a single word or pdf file for submission via Canvas.
- Show all calculations and steps clearly. Separate marks will be awarded for correct answers and steps.
- Display all non-integer numeric values at 4 decimal places unless otherwise specified.
- If you have any enquiries during the exam, please call the following hotlines:
  - C01 and C02 sessions: 3442-7483;
  - C03 session: 3442-9634;
  - CA1 and CM1: 3442-8568;
  - Or, leave a message in Zoom chat room.

Allowed materials:

- Approved calculators, lecture notes and statistical tables

Academic honesty pledge:

I hereby pledge that the answers in this exam are my own and that I will not seek or obtain an unfair advantage in producing these answers. Specifically,

- *I will not plagiarize (copy without citation) from any source;*
- *I will not communicate or attempt to communicate with any other person during the exam; neither will I give or attempt to give assistance to another student taking the exam; and*
- *I will use only approved devices (e.g., calculators) and/or approved device models.*
- *I understand that any act of academic dishonesty can lead to disciplinary action.*

Signature: _____ *Date:* _____

Question 1 (7 marks)

Alan and Ben advance to the final of a tennis tournament and will play with each other. The final has five sets and whoever wins three sets of the final first will be the champion. In any one set, Alan's chance of winning is 0.4. Assuming that both players perform independently in each set. What is the probability that Alan will be the champion?

(7 marks)

Question 2 (10 marks)

Mr. Chan is facing the following Loss Amount distribution:

Loss Amount	Probability
0	0.80
1000	0.15
2000	0.04
5000	0.01

(a) Find the expected value and standard deviation of the Loss Amount.

(3 marks)

(b) Determine the median Loss Amount, and describe the shape of the Loss Amount distribution by comparing the median with the results obtained in part (a).

(3 marks)

Instead of facing these possible losses, Mr. Chan can purchase an insurance policy; the expected value and standard deviation of the Loss Amount under the insurance policy are 330 and 84.2615, respectively. Mr. Chan will make the insurance purchase decision by minimizing the loss of utility $\mu + 0.1\sigma$, where μ = expected loss amount, and σ = standard deviation of loss amount.

(c) Will Mr. Chan purchase the insurance policy?

(4 marks)

Question 3 (10 marks)

Let $X_1, X_2, \ldots, X_n$ form a random sample of size n from some probability distribution with mean μ and variance σ^2. If n is greater than 60,

(a) What is the distribution of sample mean? Explain.

(3 marks)

(b) Compute the probability that the sample mean is exactly 2.

(2 marks)

(c) Compute the probability that the sample mean is within $\mu \pm 1.6\sigma_{\bar{X}}$.

(5 marks)

Question 4 (25 marks)

An IT company has 500 employees. 40% of the employees are women, 60% of the employees are married, and of those married, 15% are women.

(a) What is the probability that a randomly selected employee is a woman or is married?

(4 marks)

(b) What is the probability of selecting a male and married employee?

(3 marks)

(c) An employee is randomly selected and is a male, what is probability that he is married?

(3 marks)

(d) Consider the employees in this IT company as a sample, at 5% level of significance, is there evidence that the population proportion of married IT employees is 55%? Specify the required conditions of your test.

(12 marks)

(e) Given all other factors remain unchanged, if the sample size increases, will the decision in part (d) changed? Explain.

(3 marks)

Question 5 (23 marks)

The owner of a shopping mall studied the shopping habits of his customers. In order to estimate the mean time spent by shoppers, a random sample of 10 shoppers is selected and their time spent (in minutes) in the mall are as follows:

73.2 59.8 46.7 53.4 69.8 45.6 64.5 50.2 64.8 27.9

(a) Determine the five number summary of this sample.

(5 marks)

(b) What assumption will have to be made if we want to construct a confidence interval for the mean time spent by all shoppers in the mall? Explain.

(4 marks)

(c) Construct an 80% confidence interval for the mean time spent by all shoppers in the mall. Interpret the result.

(7 marks)

(d) Based on the result of part (c), at 20% level of significance, should we reject the null hypothesis for $\mu = 75$ minutes? Explain.

(3 marks)

(e) In order to make the estimation of population mean corrected to within ±3 minutes at 95% confidence, what is the minimum sample size?

(4 marks)

Question 6 (25 marks)

John would like to buy an apartment at One Beacon Hill, Kowloon Tong, so as to reduce his travel time to work. He is trying to estimate how apartment price (Y, measured in million HK dollars) is influenced by the gross floor area (X, measured in square feet). After randomly choosing 15 records from property.hk, John conducts a simple linear regression analysis on the data. The partial Excel output is shown as below:

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1870.1962	1870.1962	175.3678	6.3550E-09
Residual	13	138.6375	10.6644		
Total	14	2008.8338			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-9.3201	7.0544	-1.3212	0.2092	-24.5604	5.9202
X	0.0278	0.0021	???	???	0.0233	0.0324

(a) State the estimated simple linear regression equation.

(3 marks)

(b) Interpret the estimated slope of the regression equation.

(2 marks)

(c) Find the coefficient of correlation. Interpret the result.

(5 marks)

(d) Use critical value approach, test the claim that there is a positive linear relationship between the apartment price and gross floor area at the level of significance 0.01.

(8 marks)

(e) Predict the price for an apartment with gross floor area

(i) 1200 square feet, and

(ii) 1800 square feet.

(2 marks)

(f) Given that the observed X values ranged between 1400 square feet and 2500 square feet, of the two predictions obtained for (i) and (ii) in part (e), which is more justifiable? Explain why.

(2 marks)

(g) Discuss the significance of the intercept coefficient and suggest a modified model.

(3 marks)

- End -