UNIVERSITI TEKNOLOGI MARA
FINAL EXAMINATION

COURSE	:	INTRODUCTION TO PROBABILITY AND STATISTICS
COURSE CODE	:	STA116
EXAMINATION	:	JUNE 2019
TIME	:	2 HOURS

INSTRUCTIONS TO CANDIDATES

1. This question paper consists of six (6) questions.
2. Answer ALL questions in the Answer Booklet. Start each answer on a new page.
3. Do not bring any material into the examination room unless permission is given by the invigilator.
4. Please check to make sure that this examination pack consists of :
   i) the Question Paper
   ii) a graph paper – provided by the Faculty
   iii) an Answer Booklet– provided by the Faculty
   iv) a two – page Appendix 1 (List of Formulae)
   v) a Statistical Table – provided by the Faculty
5. Answer ALL questions in English.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

This examination paper consists of 5 printed pages

QUESTION 1

a) Yayasan Cempaka is a non-government organisation focusing on disabled children. They have a total of 1200 registered volunteers as of December 2018. The table below classifies the volunteers according to regions.

Region	Number of volunteers
Northern	250
Southern	180
Eastern	150
Central	380
Borneo	240

Construct a pie chart to represent the information.

(4 marks)

b) The number of journals read per semester by 20 final year college students is given below.

18	15	18	21	10	8	19	15	11	20
12	12	15	17	21	20	15	13	15	11

i) Find the mean, median and mode for the above data.

ii) Explain the meaning of the value of the mode obtained.

(6 marks)

QUESTION 2

a) Three bands and two comics are performing for a talent show. Determine the number of different arrangements of programs that can be set for the show if the comics must perform in between the bands.

(2 marks)

b) A team consisting of six members is to be formed from five boys and four girls. Determine the number of different teams that can be formed if the team must consist of at least four boys.

(3 marks)

c) In a recent survey concerning the issue of increased intersession fees, the following data were obtained in response to the question, "If the fees of intersession classes were increased, would you be more likely to enrol in one of them?".

Class	Yes	No	No opinion
Non-graduating students	150	80	50
Graduating students	240	60	20

If a student is selected at random, find the probability that the student

i) has no opinion.

ii) is a non-graduating student or is against the issue.

(5 marks)

QUESTION 3

The following table lists the probability for the number of breakdowns of a machine per week based on past data.

Number of breakdowns	0	1	2	3
Probability	0.15	0.20	0.35	k

a) Show that the value of k = 0.3.

(2 marks)

b) Find the probability that the number of breakdowns for the machine during a given week is

i) at most 1.

ii) more than 1.

(4 marks)

c) Calculate

i) the expected number of breakdowns per week.

ii) E(5X-2).

(4 marks)

QUESTION 4

An office supply company conducted a survey before marketing a new paper shredder designed for home use. In the survey, 80% of the people who used the shredder were satisfied with it. Because of this high acceptance rate, the company decided to market the new shredder. On a certain day, seven customers bought this shredder. Find the probability that, out of these seven customers,

a) exactly four customers will be satisfied.

(2 marks)

b) more than one customer will be satisfied.

(4 marks)

c) at most one customer will not be satisfied with the new shredder.

(4 marks)

QUESTION 5

The probability density function of a continuous random variable Y is given by

$$f(y) = \begin{cases} c(3y+2) & 0 < y < 2 \\ 0 & \text{elsewhere} \end{cases}$$

a) Show that the value of c = 0.1.

(3 marks)

b) Calculate the probability that Y is more than 1.2.

(4 marks)

c) Find E(Y).

(3 marks)

QUESTION 6

The heights of male teenagers are normally distributed with mean 165 cm and variance 9 cm. Any male teenager whose height is more than 175 cm is defined as tall.

a) Calculate the probability that a randomly selected male teenager has a height between 160 cm and 170 cm.

(3 marks)

b) Calculate the probability that a randomly selected male teenager is tall.

(3 marks)

c) If half of the male teenagers have a height greater than k, find the value of k.

(4 marks)

END OF QUESTION PAPER

FORMULA LIST

Sample measurements

1. Mean, $\bar{x} = \dfrac{\sum x}{n}$ or $\dfrac{\sum fx}{n}$

2. Median, $\tilde{x} = L_m + \left(\dfrac{\dfrac{n}{2} - \sum f_{m-1}}{f_m} \right) \cdot C$

3. Mode, $\hat{x} = L_{mo} + \left(\dfrac{\Delta_1}{\Delta_1 + \Delta_2} \right) \cdot C$

4. Standard Deviation, $s = \sqrt{\dfrac{1}{n-1}\left[\sum (x - \bar{x})^2 \right]}$ or $\sqrt{\dfrac{1}{n-1}\left[\sum x^2 - \dfrac{\left(\sum x\right)^2}{n} \right]}$

   $\sqrt{\dfrac{1}{n-1}\left[\sum f(x - \bar{x})^2 \right]}$ or $\sqrt{\dfrac{1}{n-1}\left[\sum fx^2 - \dfrac{\left(\sum fx\right)^2}{n} \right]}$

5. Coefficient of variation, $cv = \dfrac{s}{\bar{x}} \times 100$

6. Pearson's measure of skewness $= \dfrac{\text{mean} - \text{mode}}{\text{standard deviation}}$ or $\dfrac{3(\text{mean} - \text{median})}{\text{standard deviation}}$

where

n = $\sum f$
L_m = lower median class boundary
L_{mo} = lower modal class boundary
$\sum f_{m-1}$ = cumulative frequencies for the classes before the median class
f_m = median class frequency
Δ_1 = (modal class frequency) - (frequency for the class before the modal class)
Δ_2 = (modal class frequency) - (frequency for the class after the modal class)
C = class size

Probability

If A and B are two events,

1. Additive rule 1 (not mutually exclusive events)
   $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

2. Additive rule 2 (mutually exclusive events)
   $P(A \cup B) = P(A) + P(B)$

3. Multiplication rule 1 (independent events)
   $P(A \cap B) = P(A) \cdot P(B)$

4. Multiplication rule 2 (dependent events)
   $P(A \cap B) = P(A) \cdot P(B \mid A)$

5. Conditional probability
   $$P(B \mid A) = \frac{P(A \cap B)}{P(A)}$$

6. Bayes' Theorem
   $$P(B_i \mid A) = \frac{P(B_i \cap A)}{P(A)} \quad \text{for } i = 1,2,\ldots,k$$
   where $P(A) = P(B_1) \cdot P(A \mid B_1) + P(B_2) \cdot P(A \mid B_2) + \ldots + P(B_k) \cdot P(A \mid B_k)$

Probability Distribution

1. Uniform
   $$P(X = x) = \frac{1}{k}, \quad x = x_1, x_2, \ldots, x_k$$
   Mean, $\mu = \dfrac{k+1}{2}$ Variance, $\sigma^2 = \dfrac{k^2 - 1}{12}$

2. Binomial
   $P(X = x) = {}^nC_x p^x q^{n-x}, \quad x = 0,1,2,\ldots,n$
   Mean, $\mu = E(X) = np$ Variance, $\sigma^2 = Var(X) = npq$

3. Poisson
   $$P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}, \quad x = 0,1,2\ldots$$
   Mean, $\mu = E(X) = \lambda$ Variance, $\sigma^2 = Var(X) = \lambda$