



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER I  
SESSION 2020/2021**

COURSE NAME : PROBABILITY AND STATISTICS II  
COURSE CODE : BWB 10503  
PROGRAMME CODE : BWA / BWQ  
EXAMINATION DATE : JANUARY / FEBRUARY 2021  
DURATION : 3 HOURS  
INSTRUCTION : ANSWERS ALL QUESTIONS  
OPEN BOOK EXAMINATION

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THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

**PART A**

**Q1** Which of the following is **NOT** a condition for Geometric distribution?

- A The trials are independent
- B The outcome of each trial is deemed either a success or a failure
- C The probability,  $p$ , of a successful outcome is the same for each trial
- D The number of trials needed to obtain the first failed outcome

(2 marks)

**Q2** Determine the **FALSE** statement about the Multinomial distribution.

- A All the partitions occur with equal probability
- B Each trial have two possible outcomes
- C All the partitions are mutually exclusive
- D An extension of the family of binomial distributions

(2 marks)

**Q3** Classify the following random variable as Exponential or Gamma distribution

- I Component failure data
- II Waiting times for service at queues
- III Time to failure of electrical systems

- A All are Exponential distribution
- B All are Gamma distribution
- C I and II are Gamma distribution
- D Only II is Exponential distribution

(2 marks)

**Q4** Which of the following is the **FALSE** statement about Hypergeometric distribution?

- A There are only two possible outcomes on each trial
- B The experiment consists of randomly drawing  $n$  outcomes without replacement
- C The trials are not independent
- D None of these

(2 marks)

**Q5** Which of the following is not a requirement for binomial experiment?

- A There are two outcomes for each trial
- B There is a fixed number of trials
- C The probability of success must be the same for all trials
- D The outcomes must be dependent

(2 marks)

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**Q6** Recognize the type of distribution for the following random variable.

- I** The number of emergency call received by an ambulance control in an hour
  - II** The number of vehicles approaching a motorway toll bridge in the five-minute interval
- 
- A** Exponential distribution
  - B** Gamma distribution
  - C** Uniform distribution
  - D** None of these

(2 marks)

**Q7** Are the following statements **TRUE** or **FALSE**?

- I** Exponential distribution is a particular case of the gamma distribution
  - II** Exponential distribution follows the Poisson process
- 
- A** Both true
  - B** Both false
  - C** **I** true , **II** false
  - D** **I** false , **II** true

(2 marks)

**Q8** Which distribution can be used when there are three or more outcomes?

- A** Multinomial distribution
- B** Hypergeometric distribution
- C** Negative Binomial distribution
- D** Geometric distribution

(2 marks)

**Q9** Which distribution requires sampling to be done without replacement?

- A** Negative Binomial distribution
- B** Multinomial distribution
- C** Geometric distribution
- D** Hypergeometric distribution

(2 marks)

**Q10** Which distribution can be used to determine the probability of an outcome occurring on a specific trial?

- A** Negative Binomial distribution
- B** Hypergeometric distribution
- C** Multinomial distribution
- D** Geometric distribution

(2 marks)

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**Q11** Which distribution does not require a binomial experiment?

- A Exponential distribution
- B Hypergeometric distribution
- C Multinomial distribution
- D Geometric distribution

(2 marks)

**Q12** Which of the following is a continuous probability distribution?

- A Exponential distribution
- B Geometric distribution
- C Hypergeometric distribution
- D Negative Binomial distribution

(2 marks)

**Q13** Is the following statement always true, sometimes true, or always false?

“The beta distribution is the result of a complex transformation of a random  $F$  variable and only defined between 0 and 1.”

- A Always true
- B Sometimes true
- C Always false
- D Not sure

(2 marks)

**Q14** Determine the **TRUE** statement about sampling.

- A Simple random sampling defined as selecting  $n$  sampling units in such a way that each possible sample of size  $n$  has the same chance of being selected
- B Cluster random sampling is easy to prepare a list of each part that constitutes a frame
- C Systematic sampling is easy to employ and more precise than simple random sampling
- D The sampling units for stratified random sampling in each strata are similar

(2 marks)

**Q15** Which of the following is the **FALSE** statement?

- A The mean of the sampling distribution is the same as the mean of the population
- B The standard deviation of the sampling distribution is much bigger than that of the population
- C The larger the sample size, the better the approximation to the normal distribution
- D By the central limit theorem, the total measurement error will approximately follow a normal distribution

(2 marks)

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**Q16** Determine the **FALSE** statement.

- A The efficient estimator has the smallest variance
- B For a consistent estimator, as the sample size decreases, the value of the estimator approaches the value of the parameter estimate
- C All unbiased estimators are consistent estimators
- D Point estimates can be computed by the method of moments or by the maximum likelihood method

(2 marks)

**Q17** Determine the **TRUE** statement.

- A For the same confidence level, the smaller the interval width, the larger the sample size required
- B For the same sample size, the greater level of confidence, the wider the confidence interval
- C For the same interval width, the greater the level of confidence, the larger the sample size required
- D All of these

(2 marks)

**Q18** Are the following statements **TRUE** or **FALSE**?

- I  $H_0$  is true and your test leads you to reject  $H_1$  – correct decision
- II  $H_0$  is false and your test leads you to reject  $H_0$  – correct decision
- III  $H_0$  is true and your test leads you to reject  $H_0$  – Type I error
- IV  $H_0$  is false and your test leads you to reject  $H_0$  – Type II error

- A All true
- B Only I true
- C I and II – true ; II and III – false
- D Only III – false

(2 marks)

**Q19** Determine the appropriate test for the situations given below.

- I A cigarette firm claims that all cigarettes presently being sold have an average nicotine content of at least 1.5 milligrams per cigarette
- II A water official insists that the average daily household water use in a certain county exceeds 400 gallons
- III An advertisement for toothpaste claims that this product's use significantly reduces the number of cavities of children in their cavity-prone years

- A All use right-tailed test
- B All use left-tailed test
- C All use a one-tailed test
- D All use a two-tailed test

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**Q20** Determine the **FALSE** statement about the power test.

- A The probability of making a type II error
- B The probability of making a type I error
- C Sometimes called statistical power
- D The probability of rejecting  $H_0$  when  $H_1$  is true

(2 marks)

**PART B**

**Q1** (a) A female darts player is throwing a dart at the bull's eye on a dartboard. Independently for each throw, her probability of hitting the bull's eye is 0.2. Let  $X$  be the number of throws she makes, up to and including her first success.

(i) Write down the distribution of  $X$  and give the name of the distribution.

(2 marks)

(ii) Find the probability that she will have at least three failures before her first time success.

(4 marks)

(b) A manager of a manufacturing company has eight female and twelve male engineers in her department. The manager randomly selected a team of six engineers to attend a business meeting. Find the probability that the team had

(i) two female engineers.

(4 marks)

(ii) at least two male engineers.

(5 marks)

(c) The time  $T$ , in minutes, between the arrivals of two successive patients in an emergency room is a random variable with mean 20 minutes. Determine the probability that the time between two successive patients is less than 25 minutes.

(5 marks)

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**Q2** In a market research survey, 25 people out of a random sample of 100 in a certain town said that they regularly used a particular brand of soap.

(a) Obtain a 97% confidence interval for the proportion of people in the town who regularly use this brand of soap. Interpret the result.

(9 marks)

(b) Determine the required sample size if the margin of error reduced to  $e = +0.05$  at 90% confidence interval

(6 marks)

(c) If a random sample of 500 people has been surveyed and a 95% confidence interval calculated for each, estimate the number of people who regularly use this brand of soap.

(2 marks)

(d) Find an unbiased estimate of the percentage of people that regularly used a particular brand of soap.

(3 marks)

**Q3** An investigation was conducted onto the dust content in two types of solid fuel boilers in the fuel gases. Thirteen boilers of type A and nine boilers of type B were used under identical fuelling and extraction conditions. Over a similar period, in grams, the following quantities of dust were deposited in similar traps inserted in each of the 22 flues.

Type A boilers : 73.1, 56.4, 82.1, 67.2, 78.7, 75.1, 48.0, 53.3, 55.5, 61.5, 60.6, 55.2, 63.1

Type B boilers : 53.0, 39.3, 55.8, 58.8, 41.2, 66.6, 46.0, 56.4, 58.9

(a) Find the mean and variance of each of the samples.

(4 marks)

(b) Use a 5% level of significance to determine whether there is any difference between the two samples regarding the mean of deposited dust.

(12 marks)

(c) Based on your conclusion in **Q3 (b)**, what type of error that you possibly made? Explain in the context of the problem.

(4 marks)

- END OF QUESTIONS -

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