UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	STATISTICS & PROBABILITY II
COURSE CODE	:	BWB 10303
PROGRAMME	:	2 BWA
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS EXAMINATION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Show that the expected value for the following distribution is given as follow:

(i) Binomial: $E(X) = np$; where n is number of trials and p is the probability of success.

(5 marks)

(ii) Hypergeometric: $E(X) = \frac{rn}{(r+w)}$; where r is the number of success, w is number of failure, n random sample drawn from total population, N.

(5 marks)

(b) Explain the difference between the following probabilities.

(i) Binomial Distribution and Negative Binomial Distribution.

(2 marks)

(ii) Poisson Distribution and Gamma Distribution.

(2 marks)

(iii) Geometric Distribution and Negative Binomial Distribution.

(2 marks)

Q2 (a) Peter has 40% chance each year of having his tax returns audited because of he has poor past record.

(i) Calculate the probability that he will be audited for the first time after being escape for four years.

(4 marks)

(ii) Calculate the probability that he will escape tax audit for at least three years.

(3 marks)

(b) An Arctic weather station has three electronic wind gauges. Only one is used at any given time. The lifetime of each gauge is exponentially distributed with mean of 1000 hours.

(i) Compose the probability density function for the random variable measuring the time until the last gauge wear out.

(5 marks)

(ii) From your answer in Q2(b)(i), calculate the probability the last gauge wear out less than 900 hours

(4 marks)

(iii) Find the probability the second gauge wear out after 500 hours.

(6 marks)

(c) A manufacturer has 20 machines that cut cardboard boxes. The probability that, on a given day, any one machine will be working properly is 0.75.

(i) If the day's production requires the availability of at least 11 machines, compute the probability that the work will get done.

(6 marks)

(ii) Compose the probability that on any given day, less than eight machines are working.

(4 marks)

Q3 (a) Explain the difference between maximum likelihood estimator and maximum likelihood estimate.

(2 marks)

(b) Suppose a random sample of size n is drawn from the two-parameter normal probability density function which given as follow:

$$f\left(x;\mu,\sigma^2\right)=\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{1}{2}\left[\frac{x-\mu}{\sigma}\right]^2},\quad -\infty<x<\infty;-\infty<\mu<\infty;\sigma^2>0$$

(i) Construct the maximum likelihood estimator for the two parameters, μ_e and σ_e.

(11 marks)

(ii) Construct the formulas for estimators of μ and σ by using method of moments.

(6 marks)

(iii) Compare your answers in Q3(b)(i) and Q3(b)(ii).

(2 marks)

Q4 A food manufacturing company has bought two new machines to fill chocolate powder into containers. They want to test whether the machines are able to fill the chocolate powder according to specific weight, so they take nine random samples of containers are filled from the two machines. The data are shown in **Table Q4**.

Table Q4: Weight of chocolate powder in container (in kg)

Machine 1	10.19	10.08	9.91	9.95	9.91	10.06	10.03	9.85	10.12
Machine 2	10.01	9.98	9.89	9.91	9.79	10.02	10.04	9.91	10.06

(a) Assume that the chocolate powder weight distributed as normal distribution, find the point estimates of mean and variance for both machines.

(4 marks)

(b) Construct interval estimation with significance level of 0.01 for the mean weight produced by Machine 1.

(6 marks)

(c) By assuming that the variances for both machines are unequal, construct interval estimation with significance level of 0.05 for the difference between mean weight produced by Machine 1 and Machine 2.

(7 marks)

(d) Test the hypothesis that the Machine 2 produced standard deviation weight that is less than 0.1 at significance level of 0.05.

(6 marks)

(e) Is there an evidence that the Machine 1 and Machine 2 produced similar standard deviation weight at significance level of 0.05?

(8 marks)

- END OF QUESTION –

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Formulae

$$S_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}; \qquad v = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

$$\chi^2_{Test} = \frac{(n-1)s^2}{\sigma^2}; \qquad F_{Test} = \frac{s^2_1}{s^2_2}$$