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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	STATISTICS AND PROBABILITY II
COURSE CODE	:	BWB 10303
PROGRAMME	:	1 BWB
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1 Imagine that you are a statistician that will handle any type of data that needs to be characterized by its distribution. Explain in detail the relationship of the development of all distribution models as presented in **Figure Q1**. The explanation should include the limiting distributions, the probability distribution function and properties of each distribution models. [Hint: Your explanation should start from Bernoulli process to the Gauss/Normal distribution].

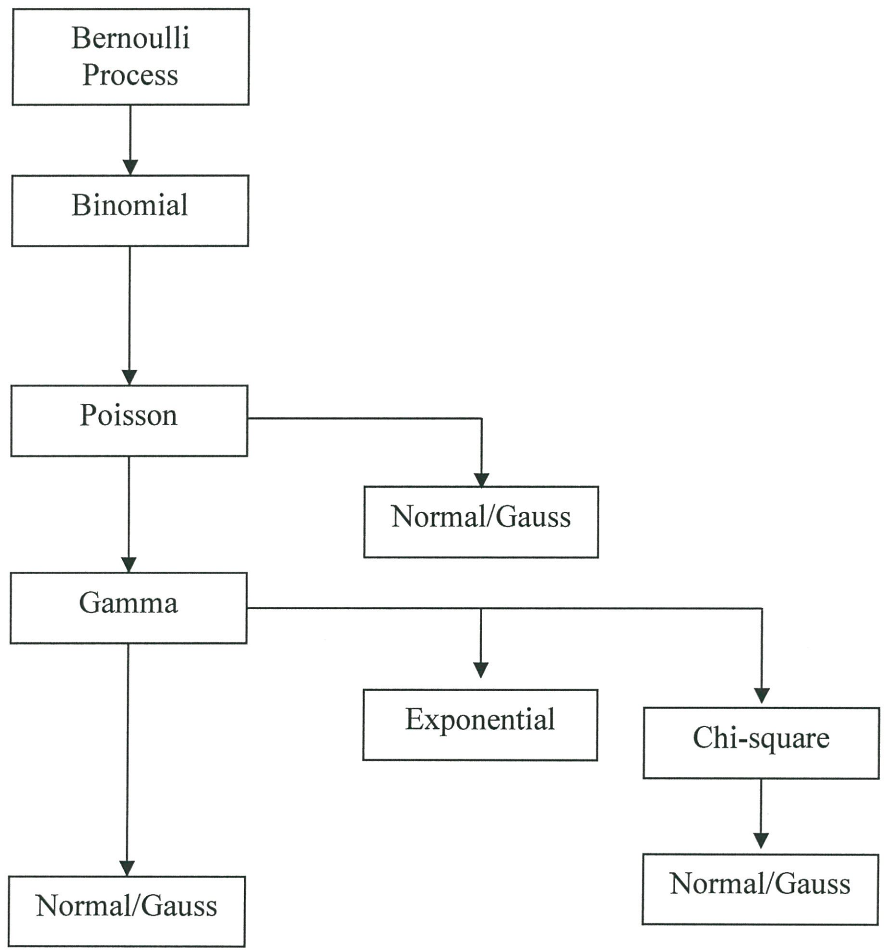

Figure Q1: Roadmap of the development of distribution models

(25 marks)

Q2 If random variable X has the probability density function of

$$f(x)=\begin{cases}\theta^{-1}e^{\frac{-x}{\theta}} & ,x\geq 0 \text{ and } \theta>0\\ 0 & \text{, elsewhere}\end{cases}$$

(a) Show that the probability density function is valid.

(5 marks)

(b) Derive the moment generating function of that probability density function.

(5 marks)

(c) Using the result obtained in (b), find the mean and variance of X.

(6 marks)

(d) Find the maximum likelihood estimation of θ.

(6 marks)

(e) Suppose 10 rats are used in a biomedical study where the rats are injected with cancer cells and given a cancer drug that is designed to increase their survival rate. The survival times, in months, are given as follows:

14	17	27	18	12	8	22	13	19	12

By using result in (d), estimate the mean survival.

(3 marks)

Q3 (a) List two properties of a good estimator.

(2 marks)

(b) Explain one of that property in (a).

(2 marks)

(c) If X is a random variable having the binomial distribution with the parameters n and θ, show that $n.\frac{X}{n}.\left(1-\frac{X}{n}\right)$ is a biased estimator of the variance of X.

(9 marks)

(d) Given $X_1, X_2, \ldots, X_n$ constitute a random sample of size n from a normal population with the mean, μ and the variance, σ^2. Derive the maximum likelihood estimates of μ and σ^2.

(12 marks)

Q4 The following are the heat producing capacities of coal from two mines (in millions of calories per ton):

Mine A	8500	8330	8480	7960	8030	8000	8100	
Mine B	7710	7890	7920	8270	7860	8010	8003	7950

Assume that the data constitute independent random samples from normal distribution with equal variances.

(a) Construct a 99% confidence interval for the difference between the true average of heat producing capacities of coal from the two mines. What is your conclusion?

(9 marks)

(b) Test at $\alpha = 0.10$ whether the heat producing capacities of coal from Mine A is higher compared to the heat producing capacities of coal from Mine B. What is your conclusion?

(8 marks)

(c) Test at $\alpha = 0.05$ whether it is reasonable to assume that the two mines have equal variances. What is your conclusion?

(8 marks)

- END OF QUESTION –