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**UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE**

**ALLIED HEALTH SCIENCES DEGREE PROGRAMME**

**FIRST BPHARM PART II EXAMINATION - FEBRUARY 2013**

**PH 1262 - BIostatISTICS I**

DATE: 22.02.2013

TIME : 9.00 a.m -11.00 a.m

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**INSTRUCTIONS**

- No paper should be removed from the examination hall.
- Marks will be penalized for illegible hand writing.
- Do not use any correction fluid.
- **Answer all Questions.**

1.

- State the Bayes' rule in the usual notation.
- Suppose that infants are classified as low birth weight if they have a birth weight  $\leq 2500g$  and as normal birth weight if they have a birth weight  $\geq 2501g$ . Suppose that infants are also classified by period of gestation in the following four categories:

<20 weeks, 20-27 weeks, 28-36 weeks, >36 weeks.

Assume that the probabilities of the different periods of gestation are as given in the following table:

Period of gestation	Probability
<20 weeks	0.0004
20-27 weeks	0.0059
28-36 weeks	0.0855
>36 weeks	0.9082

Also assume that the probability of being low birth weight given that the period of gestation is <20 weeks is 0.54, the probability of being low birth weight given that the period of gestation is 20-27 weeks is 0.813, the probability of being low birth weight given that the period of gestation is 28-36 weeks is 0.379, and the probability of being low birth weight given that the period of gestation is >36 weeks is 0.035.

- Find the probability of having a low birth weight infant.
- Find the probability of having a period of gestation 28-36 weeks given that a child is low birth weight.

(20 marks)

2. Consider a family with a mother, father and two children of ages 7 and 5 years respectively. Let  $A_1 = \{ \text{mother has influenza} \}$ ,  $A_2 = \{ \text{father has influenza} \}$ ,  $A_3 = \{ \text{first child has influenza} \}$ , and  $A_4 = \{ \text{second child has influenza} \}$ .

a)

- i. What does  $A_1 \cup A_2$  mean?
- ii. What does  $A_1 \cap A_2$  mean?
- iii. Are  $A_3$  and  $A_4$  mutually exclusive? Explain your answer.

- b) Suppose that an influenza epidemic strikes the city where the above family live. In 10% of families the mother has influenza; in 10% of families the father has influenza; and in 2% of families both the mother and father have influenza.

- i. Write  $P(A_1)$ ,  $P(A_2)$  and  $P(A_1 \cap A_2)$ .
- ii. Find  $P(A_1 \cup A_2)$ .

- c) Let  $X$  be the random variable representing the number of **adults** with influenza in a family considered in part (b).

- i. Show that the possible values for  $X$  are 0, 1 and 2.
- ii. Find the probability distribution for this random variable.
- iii. Calculate its expected value.
- iv. Calculate its variance.

(30 marks)

3. The probability that a person suffering from migraine will obtain relief with a particular drug is 0.9. Three randomly selected suffers from migraine are given the drug. Find the probability that the number obtaining relief will be:

- a) Exactly one.
- b) More than one.
- c) Two or fewer.
- d) Two or three.

(20 marks)

4. Nicotine levels in smokers are modeled by a random variable  $T$  with a normal distribution with mean 315 and standard deviation 131.

- a) What is the probability that  $T$  is more than 450?
- b) What is the third quartile of the nicotine level distribution?
- c) What is the probability  $P(150 \leq T \leq 400)$ ?
- d) What nicotine level is such that 20% of smokers have a higher level?
- e) What is the probability that a smoker's nicotine level is between 215 and 300 or between 350 and 400?

(30 marks)