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Original

UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE

ALLIED HEALTH SCIENCES DEGREE PROGRAMME

FIRST BPHARM PART II EXAMINATION - AUGUST 2014

PH 1262 - BIOSTATISTICS I (SEQ)

INDEX NO: .....

TIME: TWO HOURS

INSTRUCTIONS

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

1.

(a) Briefly describe the following types of variables:
   (i) Categorical
   (ii) Numerical
   (iii) Discrete
   (iv) Continuous

(b) Briefly describe the following distribution shapes:
   (i) Uni-, bi-, and multimodal distributions
   (ii) Symmetric and Skewed distributions

(c) How are the mean, median, and mode interrelated in the symmetric and skewed distributions?

(d) Write the most appropriate measurement for the center of the distribution when the distributions are
   (i) Symmetric, and
   (ii) Skewed

(25 marks)

2.

(a) If A_1, A_2 and A_3 are mutually exclusive events whose union is the sample space S of an experiment and B is an arbitrary event of S such that $P(B) \neq 0$, then the probability A_1 given B can be written as follows:

$$P(A_1 \mid B) = \frac{P(A_1)P(B \mid A_1)}{\sum_{r=1}^{3} P(A_r)P(B \mid A_r)}$$

Write down the results for $P(A_2|B)$ and $P(A_3|B)$.

(b) A factory has three machines 1, 2 and 3, producing a particular type of item. One item is drawn at random from the factory's production. Let B denote the event that the chosen item is defective and let A_k denote the event that the item was produced on machine k where k=1, 2 or 3. Suppose that machines 1, 2 and 3 produce respectively 35%, 45% and 20% of the total production of items and that

$$P(B|A_1) = 0.02,\ P(B|A_2) = 0.01,\ P(B|A_3) = 0.03.$$

(i) Calculate $P(A_1 \mid B), P(A_2 \mid B)$ and $P(A_3 \mid B)$.

(ii) Given that an item chosen at random is defective, write down which machine was the most likely to have produced it. Explain your reasoning.

(25 marks)

3.

(a) Packets of food are filled automatically and the proportion of packets in very large batch which are underweight is p. A sample size n is selected randomly from the batch and the probability that the sample contains exactly r defective packets (r=1,2,3,...,n) follows a certain probability distribution.

(i) Name the distribution.

(ii) Write down the probability that the sample contains exactly r defective packets.

(b) For one particular process it has been found in the past that 2 per cent of the packets are underweight. An inspector takes a random sample of ten packets. Calculate

(i) The expected number of packets in the sample which are underweight,

(ii) The probability that none of the packets in the sample are underweight,

(iii) The probability that more than one of the packets in the sample is underweight.

(25 marks)

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4. Vitamin **E** capsules are produced by a certain machine. The actual amount of vitamin **E** in each capsules is normally distributed with a mean of 5 mg and a standard deviation of 0.05 mg. If a capsule is randomly selected, what is the probability that the amount of vitamin **E** is,
   (a) less than 4.9 mg,
   (b) at least 5.16 mg ,
   (c) between 4.85 mg and 5.15 mg,
   (d) Find the point that has the property that 10% of all capsules have amount of vitamin **E** of this value or lower.

(25 marks)