CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2013/14

Module Title: Statistics &Probability

Module Code: **STAT 6000**

School: School of Science & Informatics

Programme Title:
B.Sc (Hons) in Software Development – Year 1
B.Sc (Hons) in Web Development – Year 1
B.Sc (Hons) in Software Development & Computer Networking – Year 1
B.Sc (Hons) in IT Management – Year 1
Bachelor of Science in Computing – Year 1
Higher Certificate in Science in Computing – Year 1

Programme Code:

KSDEV_8_Y1	KWEBD_8_Y1	KDNET_8_Y1
KITMN_8_Y1	KCOMP_7_Y1	KCOME_6_Y1

External Examiner(s): **Prof. E. Murphy**
Internal Examiner(s): **Dr. C. Carroll, Ms. P.Cogan, Mr. A. Daly, Ms. F. Wood**

Instructions: **Answer FOUR questions. All questions carry equal marks.**

Duration: **2 HOURS**

Sitting: Summer 2014

Requirements for this examination:

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you are attempting the correct examination.
If in doubt please contact an Invigilator.

Q1.

The data below shows the times taken for 30 people to climb Carrauntoohil in one weekend in June 2013.

Time (in minutes)

314	321	296	281	304	361
283	311	292	293	316	354
322	281	308	333	390	378
291	359	314	286	297	346
309	307	288	312	329	394

a) Represent the data on a stem and leaf diagram. Hence establish a frequency distribution having at most 6 classes.

[9 marks]

b) Draw an ogive to represent the data. (Use graph paper provided at centre of answer book)

[7 marks]

c) Use your graph to estimate the median time taken.

[3 marks]

d) Verify your answer to part (c) using an appropriate formula for the median.

[4 marks]

e) Based only on the shape of the distribution (i.e., do not calculate the mean), would you expect that

i. mean < median
ii. mean = median or
iii. mean > median?

[2 marks]

Q2.

A study was done on the amount of time first year computing students spent studying for their final exam. The results are in the table below.

Number of Minutes	Number of Students
0 but less than 30	11
30 but less than 60	20
60 but less than 120	16
120 but less than 180	37
180 but less than 210	29
210 but less than 240	7

a) Calculate the mean and standard deviation of the distribution.
Calculations are to be laid out in table form.

[10 marks]

b) Represent the data in a histogram.
Use graph paper provided at centre of answer book.

[8 marks]

c) Calculate the mode of the data and use the histogram to estimate the mode.
Is the mode a reliable measure of central tendency? Justify your answer.

[7 marks]

Q3.

a) An insurer offers a health plan to the employees of a large company. As part of this plan, the employees may choose supplementary coverages A, B and C. The proportion of employees who choose the coverages are given as follows:

$$P(A) = \frac{1}{4}, \quad P(B) = \frac{1}{3} \quad \text{and} \quad P(C) = \frac{5}{12}.$$

Determine the probability that a randomly chosen employee will choose:

(i) exactly two of the coverages
(ii) at least one coverage.

[9 marks]

b) A survey of residents in a hotel was carried out. 62% of residents booked their accommodation on line. 70% of the residents who booked on line paid their bill using a credit card, while 45% of the residents who did not book on line paid by credit card.

(i) Draw a tree diagram showing all probabilities. Confirm that they sum to1.

(ii) Find the probability that a randomly selected resident paid by credit card.

(iii) Given that a resident paid by credit card, find the probability that he did not book on line.

[9 marks]

c) A card game is taking place in a casino using a pack of 52 playing cards.
A player is dealt a card. If the card is:

- An ace, the player wins €5
- A picture card, the player wins €4
- An even number on the card, the player wins €3
- An odd number on the card, the player loses €1

(i) Calculate the expected value of his winnings.
(ii) How much should the casino charge players to play this game?

[7 marks]

Q4.

a) Wodafone, a telecoms company, finds from analysis that 25% of its customers leave each year and join a rival company, while 75% stay.

A random sample of 5 customers is selected.

(i) What is the probability that at most 1 will leave Wodafone is a given year?

(ii) If more than two of the customer from this group leaves, the company will expect to make a loss. What is the probability that the company will make a loss from this group?

[7 marks]

b) The number of students coming in to a lecturer's office follows a Poisson distribution of 12 students per 8 hour day.

Find the probability that:

(i) At least 2 students come in to the office in a given hour.

(ii) At most one student comes in the morning period 9.00 – 13.00.

[9 marks]

c) A recent survey of gamblers in the casino 'PENNIES FROM HEAVEN' showed that their winnings are approximately normally distributed about a mean of – €20 with a standard deviation of €22.
(So on average a gambler is expected to lose €20).

Find the proportion of gamblers who:

(i) breakeven or win

(ii) lose more than €50

[9 marks]

Relevant Formulae

Descriptive Statistics

Mean:

$$\bar{x} = \frac{\sum fx}{\sum f}$$

Standard Deviation:

$$s = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}} \qquad s = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

$$\text{Median} = L_M + C_M\left(\frac{\frac{1}{2}N - F_{M-1}}{f_M}\right) \qquad \text{Mode} = L_M + C_M\left[\frac{f_M - f_{M-1}}{2f_M - (f_{M-1} + f_{M+1})}\right]$$

Coefficient of Variation: $\frac{s}{\bar{x}} \times 100$ Coefficient of Skewness: $\frac{3(mean - median)}{st.dev}$

Expected Value: $E(x) = \sum_{i=1}^{n} x_i P(x_i)$

Binomial Distribution $P(r,n) = {}^nC_r p^r q^{n-r} \equiv \binom{n}{r} q^{n-r} p^r$

Poisson Distribution $P(r) = \frac{\lambda^r e^{-\lambda}}{r!}$: $P(r) = \frac{\mu^r e^{-\mu}}{r!}$

Normal Distribution Standard Units $z = \frac{x-\bar{x}}{s} = \frac{x-\mu}{\sigma}$