KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SMA 100: MATHEMATICS FOR SCIENCES 1

DATE: Monday 2nd April 2012 **TIME:** 11.00a.m – 1.00p.m

INSTRUCTIONS: Answer question ONE and any other TWO questions

QUESTION ONE (30 marks)

(a) Simplify (i) $\frac{\sqrt{10}}{\sqrt{5}} \times \frac{\sqrt{6}}{\sqrt{3}}$ (2 marks)

(ii) $\left(\frac{x^{-2}}{y^{-4}} \right)^{\frac{1}{2}}$ (1 mark)

(iii) $\frac{2^{2n+3} - (2^n)^2}{2^n}$ (2 marks)

(iv) $\frac{\log_a \left(\frac{x^3}{y} \right) + \log_a \left(\frac{y}{x} \right)}{\log_a \sqrt{x}}$ (3 marks)

(b) In a certain selection of flower seeds, $\frac{2}{3}$ have been treated to improve germination and $\frac{1}{3}$ have been left untreated. The seeds which have been treated have a probability of germination of 0.8, whereas the untreated seeds have a probability of germination of 0.5.

(i) Find the probability that a seed selected at random will germinate. (2 marks)

(ii) If the seeds were sown and given time to germinate, find the probability that a seed selected at random had been treated given that it had germinated. (2 marks)

(c) The following data indicates the price ($) of various **meals** at a restaurant.

16 15 22 18 25 27 20 23 21 28 19

The following data indicates the price ($) of various **fish** per kilo.

15 24 18 36 28 32 21 27 25

Which of the above two data sets exhibits the greatest relative variability? (3 marks)

(d) (i) Solve $x^4 + 4x^2 - 32 = 0$ (3 marks)

(ii) $x - 1$ and $x + 1$ are factors of $x^3 + ax^2 + bx + c$ and it leaves a remainder of 12 when divided by $x - 2$. Find a, b and c. (4 marks)

(e) For the GP 0.0025, 0.01, 0.04, 0.16, ... find which term of the sequence is the first to exceed 1000000. (2 marks)

(f) There are four roads going from town A to town B. In how many ways can a person go by one road and return by a different road? (2 marks)

(g) A speed boat course for the Mombasa show is a triangle ABC. It is 7 km from A to B on a bearing 010°, 8 km from B to C on a bearing 070° and then from C directly back to A. calculate the length of the course. (4 marks)

QUESTION TWO (20 marks)

(a) (i) Solve $\log_3(x+2) + 2\log_3 9 = 3$ (2 marks)

(ii) If $\log_{10} x = 2.3$ *and* $\log_{10} y = 3.4$ *evaluate* $\log_{10} \frac{x}{\sqrt{y}}$ (2 marks)

(iii) Find the relationship between a and b that does not involve logs if $2\log_3 a + 2\log_3 b = 2$ (2 marks)

(iv) The characteristic impedance of a parallel conductor (twin – lead) where dry air separates the conductors is given by

$$Z = 276 \log_{10} \frac{2D}{d}$$

where D is the separation of the conductors and d is the diameter of the conductors. Evaluate D when $d = 3.00\,mm$ *and* $Z = 250\,\Omega$. (2 marks)

(b) (i) In how many ways can a soccer forward line be arranged if there are 8 players to choose from? (2 marks)

(ii) How is the answer in (i) above affected if one of the players can play only left wing and two of the players can play only center forward? (2 marks)

(iii) The Harambee stars football team plays 11 games each season. In how many ways can the team complete the season with 6 wins, 4 losses and 1 tie? (3 marks)

(c) (i) Find the coefficient of the term x^2y^{10} in the expansion of $(x+2y)^{12}$ (3 marks)

(ii) Use the first three terms of a binomial expansion to find the approximate value of $(1.98)^8$ (2 marks)

QUESTION THREE (20 marks)

(a) (i) Find the value of x if $49^x = \frac{1}{343}$ (2 marks)

(ii) Rationalize the denominator $\frac{2}{\sqrt{5}-\sqrt{3}}$ (2 marks)

(iii) Simplify $\frac{2^{n+2}+12}{5\times 2^n+15}$ (3 marks)

(b) A farmer starts to plant trees in a set pattern. In the first row he plants 10 trees, in the second row 13 trees, in the third row 16 trees, and so on.

(i) How many trees did he plant in the 15^{th} row? (3 mark)

(ii) How many trees did he plant in total if there were only 15 rows of trees? (2 mark)

(c) Do not use trigonometrical tables in any part of this question.

In a triangle ABC, AB = 17 cm, AC = 21 cm, and BC = 10 cm. Calculate

(i) cosBAC expressing the answer as a fraction in its lowest terms, (2 marks)

(ii) sinBAC. (2 marks)

If CA is produced to D so that AD = 10 cm, calculate

(iii) $(BD)^2$ (2 marks)

(iv) The area ABD. (2 marks)

QUESTION FOUR (20 marks)

The weekly output in units of a manufacturing company has been recorded over the last 30 weeks. The data is shown below.

19	22	19	16	24	24	16	20	24	23
25	20	20	20	19	17	18	21	23	21
19	20	20	19	22	23	26	25	24	21

(a) Calculate the following measures.

(i) Mean (2 marks)

(ii) The lower, middle and upper quartiles (3 marks)

(iii) Coefficient of variation (3 marks)

(b) Group the data into class intervals starting with 16 - < 18, 18 - < 20 etc and using the frequency distribution calculate the mean giving your answer to one decimal place. (5 marks)

(c) Why is the mean found in parts (a) and (b) different? (1 mark)

(d) If α and β are the roots of the equation $2x^2 - 5x - 8 = 0$, write down the values of:

(i) $\alpha + \beta$ (2 marks)

(ii) $\alpha\beta$ (2 marks)

(iii) $\alpha^2 + \beta^2$ (2 marks)

QUESTION FIVE (20 marks)

(a) Events A *and* B are such that

$$P(A/B)=0.4,\ P(B/A)=0.25 \text{ and } P(A\cap B)=0.12$$

(i) Calculate the value of $P(B)$. (1 mark)

(ii) Give a reason why A *and* B are not independent. (1 mark)

(iii) Calculate the value of $P(A\cap \overline{B})$. (1 mark)

(b) A doctor assesses the performance of 50 nurses. It is found that 14 regularly complete their contracts behind schedule (A), 15 produce poor quality work (B) and 6 fall into both categories (A and B). A nurse is randomly selected. Find the probability that:

(i) She will be behind schedule. (2 marks)

(ii) She will be called back to remedy poor work. (2 marks)

(iii) She will be unsatisfactory (behind schedule or poor quality). (2 marks)

(c) A computer program generates random questions in arithmetic that children have to answer within a fixed time. The probability of the first question being answered correctly is 0.8. Whenever a question is answered correctly, the next question generated is more difficult and the probability of a correct answer being given is reduced by 0.1. Whenever a question is answered wrongly, the next question is of the same standard and the probability of a correct answer being given remains unchanged.

(i) Find the probability that the second question is answered correctly. (1 mark)

(ii) Find the probability that the second question is answered correctly given that the third question is answered correctly. (2 marks)

(d) A survey of university students reveals the following

	Information Technology	Accounting	Finance
MALE	400	150	50
FEMALE	200	100	100

(i) What is the probability that a student is male? (2 marks)

(ii) What is the probability that a student majors in Accounting or is Female ? (2 marks)

(iii) What is the probability that a student is Male and a Finance major? (2 marks)

(iv) What is the probability that a student is Female given that he or she majors in Information Technology? (2 marks)

END OF EXAMINATION