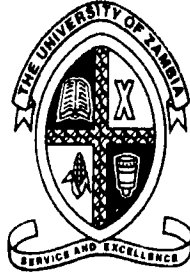


THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
SECOND SEMESTER EXAMINATION 2009

- | | |
|-----------|--|
| 1. EG 269 | INTRODUCTION TO INFORMATION TECHNOLOGY |
| 2. EG 475 | ENGINEERING, MANAGEMENT AND SOCIETY 1 |
| 3. EM 312 | ENGINEERING MATHEMATICS 4 |

SHORT LIST



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**

Semester II Final Examination

April 2010

EG 269 – Introduction To Information Technology

Time: 3 Hours

1. Answer any **THREE** questions from **SECTION A** and any **TWO** questions from **SECTION B**.
2. Section A and B should be answered in **separate** booklets

SECTION A: Answer ANY THREE questions

Question 1

- a. What are the meanings of the following terms?
 - i. 32-bit microprocessor, and 32-bit instructions [2 Marks]
 - ii. Opcode, immediate operand, and operand address [2 Marks]
 - iii. Local data bus, local address bus, and local control bus [2 Marks]
- b. Describe the machine instruction execution cycle [4 Marks]
- c. Briefly explain the four basic operations that a computer can perform [2 Marks]
- d. Describe the four major structural components of the CPU [2 Marks]
- e. Describe the four classes of interrupts [4 Marks]
- f. What happens if an interrupt occurs while an interrupt service routine (ISR) is being executed (as a result of a previous interrupt) [2 Marks]

Question 2

- a. Name any four key characteristics of computer memory system [2 Marks]
- b. What do you understand by the term *memory hierarchy*? Explain how *locality of reference* makes it achieve its goal? [3 Marks]
- c. What are the two senses in which the term *random access memory* is used? [2 Marks]
- d. What is the difference between *Dynamic* RAM and *Static* RAM, in terms of characteristics such as speed, size and cost? [2 Marks]
- e. Explain why some type of RAM is considered to be analog and the other digital [2 Marks]
- f. Define the following for a disk system:

t_s = seek time; average time to position head over track, in seconds

r = rotation speed of the disk, in revolutions per minute

n = number of bytes per sector

N = capacity of a track, in kilobytes

t_A = time to access a sector, in seconds

r_d = rotational delay or latency; average time taken for the beginning of the sector to reach the head, in seconds

t_t = transfer time; transfer time to or from disk, in seconds

- i. Develop the formula for the rotational delay or latency, r_d as a function of other parameters [3 Marks]
- ii. Develop the formula for the transfer time, t_t , as a function of other parameters [4 Marks]
- iii. Express t_A as a function of t_s , r_d and t_t [2 Marks]

Question 3

Name any three objectives of an Operating System

[3 Marks]

- List and briefly explain five storage management responsibilities of a typical Operating System. [5 Marks]
- Contrast the scheduling policies you might use when trying to optimize a time-sharing system with those you would use to optimize a multi-programmed batch system. [2 Marks]
- Suppose that we have a multi-programmed computer in which each job has identical characteristics. In one computation period, T , for a job, half the time is spent in I/O and the other half in processor activity. Each job runs for a total of N periods. Assume that a simple round-robin scheduling is used, and that I/O operations can overlap with processor operation. Define the following quantities:

Turnaround time = actual time to complete a job

Throughput = average number of jobs completed per time period T

Processor utilization = percentage of time that the processor is active (not waiting)

Compute these quantities for one and two simultaneous jobs, assuming that the period T is distributed in each of the following ways:

- I/O first half, processor second half [4 Marks]
- I/O first and fourth quarters, processor second and third quarter [6 Marks]

Question 4

- What is meant by the term *internetworking*? [1Mark]
- With the help of a diagram describe the OSI layer and explain the functions of each layer [8 Marks]
- Complete the following table of classful IP Addresses [5 Marks]

	Class A	Class B	Class C
First Octet Range	1 to 126		192 to 223
Valid Network Numbers	1.0.0.0 to 126.0.0.0		
Number of Networks in this Class			2,097,150
Number of Hosts Per Network	16,777,214	65,534	
Size of Network Part of Address (Bits)			24
Size of Host Part of Address (Bits)		16	

- What is the difference between Geography and Cartography? [1 Marks]
- Define GIS and give any two of its benefits. [2 Marks]

- f. What is the difference between a flat-file database and a relational database? [1 Mark]
- g. Explain why relational database has several advantages for geographic representation and cartographic representation? Give four reasons. [2 Marks]

SECTION B: Answer ANY TWO questions

Question 5

- a. Write a method that returns the maximum and the minimum of 3 integers.
- have the user enter them
 - generate them randomly

The main method should pass the 3 integers to the method called *maxOfThree* with the header:

public static int maxOfThree(int int1, int int2, int int3) [10 MARKS]

- b. You are to write a program using 2 methods as well as main. The main method should:
- Prompt the user to enter an integer greater than zero.
 - Pass this integer to a method named *isPositive* (the method returns a Boolean) and only continue if the number entered is greater than 0. If not the user should be re-prompted to enter a positive integer
 - Pass this integer to another method called *addNumbers*.
 - Print out the total returned from the *addNumbers* method.
 - Allow the user to repeatedly enter integers until they wish to stop.

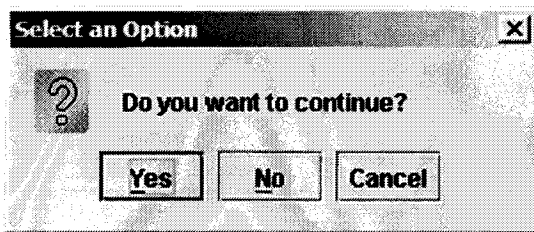
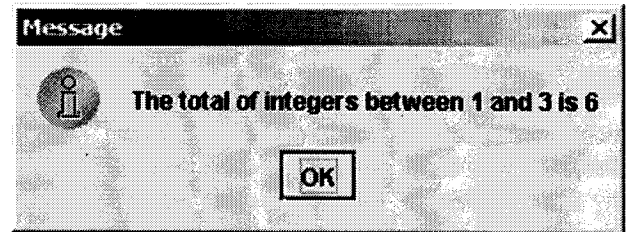
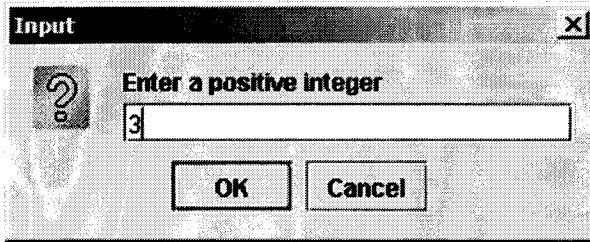
The *isPositive* method

- determines if the integer is valid i.e. positive non zero, and returns a Boolean true or false to the main method

The *addNumbers* method should:

- Add the total of all integers from 1 to the number received as a parameter inclusive, and return this value to the main method

Sample screen shots:

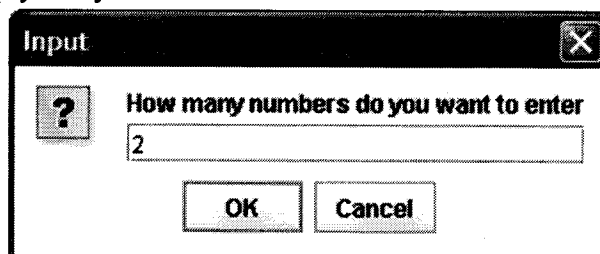


[10 MARKS]

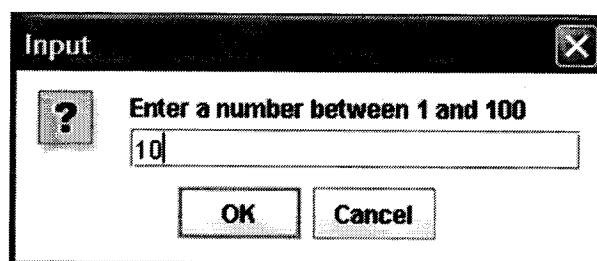
Question 6

You are to write a program in which the user enters a defined number of numbers between 1 and 100 and stores them in an array. After all the numbers are entered the program calculates and displays the square and cube of each number.

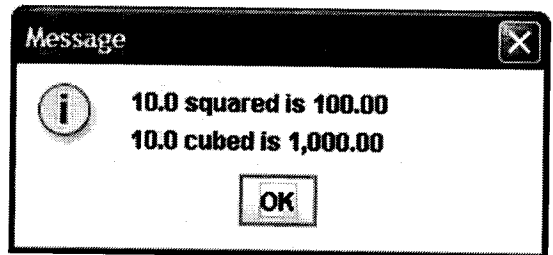
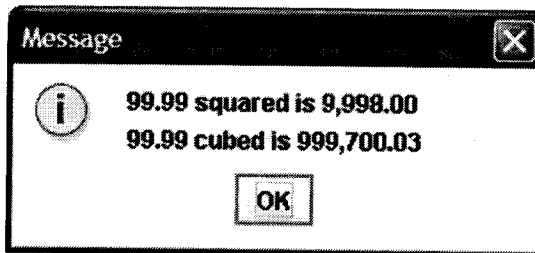
- The user is prompted for how many numbers are to be entered. (Use exception handling to ensure the number is an integer > 0 and re - prompt if invalid). The valid number is used to create an empty array of that size.



- If number entered is outside the range, no error message needs to be given, just redisplay the dialog box prompt.
- Use a *for* loop that repeats according to the number entered above, to prompt the user to enter a number (*double*) between 1 and 100. If the number is outside this range it is not accepted.



- Continue prompting the user to enter numbers until the array has been filled i.e. in this case 2 numbers between 1 and 100 have been entered.
- Write another *for* loop (same as the previous one) to process each number in the array i.e. square it and cube it and display the results to 2 decimal places



[20 MARKS]

Question 7

- A portable machine requires a force of 200 N to move it. Write a program which will be able to calculate how much work is done if the machine is moved 20 m.
- [10 Marks]
- For the circuit shown in *Figure 1*, determine with the help of a function other than main function the voltage across resistor R_3 . If the total resistance of the circuit is $100\ \Omega$, determine the current flowing through resistor R_1 . Find also the value of resistor R_2 .

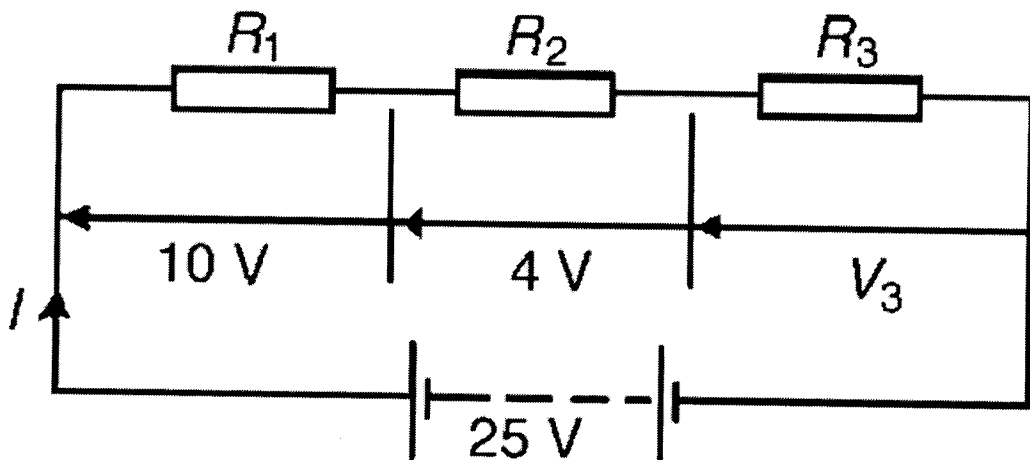


Figure 1

[10 MARKS]

**UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING**

SEMESTER II 2010 EXAMINATION

EG 475 – ENGINEERING, MANAGEMENT AND SOCIETY I

INSTRUCTIONS

1. ANSWER ONE QUESTION FROM EACH SECTION
2. ALL QUESTIONS CARRY EQUAL MARKS

TIME: THREE (3) HOURS

SECTION A

1. (a) Using a diagram critically explain the significance of price elasticity of demand and supply to the economy and business.

(b) The price of a good is K1.20 per unit and annual demand is 800,000 units. Market research indicates that an increase in price of 10 ngwee per unit will result in a fall in annual demand of 70,000 units. What is the price elasticity of demand measuring the responsiveness of the demand over this range of price increase?

(c) If the price per unit X rises from K1.40 to K1.60, it is expected that monthly demand will fall from 220,000 to 200,000 units. What is the price elasticity of demand over these ranges of price and output?
2. Consider critically:
 - (a) The factors necessary for economic growth;
 - (b) The benefits derived from economic growth; and
 - (c) Any possible adverse effects of rapid growth.
3. (a) What is meant by a balance of payment?

(b) In what ways might the attempted correction of a balance of payments deficit by central government (central bank) hinder the operations of firms in the economy?

SECTION B

4. Critically discuss the significance of a developing country like Zambia to have an industrial strategy to stimulate industrialisation and discuss some of the key elements making up an industrial strategy and their applicability to Zambia.
5. Critically discuss the link between industrialization and economic development and state what stage of economic development is Zambia within the context of Rostow model. Give reasons to support your answer.

SECTION C

6. (a) Critically discuss the significance of a Business Plan for an entrepreneur, its uses and content.
- (b) Critically discuss the importance of accounting to business.
7. (a) Describe the contribution of small businesses to an economy with which you are familiar with.
- (b) Critically discuss the entrepreneurial process.
8. (a) What is the significance of a Balance Sheet to Business?
- (b) Prepare a Balance Sheet from the following information drawn from Long's books. He presents his Balance Sheet in the order of permanence.

	Dr £	Cr £
Cash in Hand	1,000.00	
Cash at Bank	9,000.00	
Stock at Close	10,000.00	
Land and Buildings	40,500.00	
Office Equipment	4,500.00	
Creditors		4,500.00
Debtors	2,000.00	
Motor Vehicles	12,000.00	
Capital (at start)		47,000.00
Drawings	12,500.00	
Net Profits		15,000.00
Bank Loan		25,000.00
Total	£91,500.00	£91,500.00

THE UNIVERSITY OF ZAMBIA

SCHOOL OF NATURAL SCIENCES

2009 ACADEMIC YEAR
SECOND SEMESTER FINAL EXAMINATIONS

EM312: ENGINEERING MATHEMATICS IV

TIME ALLOWED: Three (3) Hours

INSTRUCTIONS : This paper is composed of **Two** sections. Each section has three questions.
Attempt any **Four (4)** questions. You must answer not more than **Two (2)** questions from each section.
You must show essential working to get full credit.
The tables for the normal distribution shall be provided.

Section I

Attempt any two questions from this section.

1. (a) (i) A surface is given by the equation
 $6x^2 + 4y^2 - z^2 + 12x - 8y + 4z - 30 = 0$. Identify the surface and write down its center.
(ii) Find an equation of the plane which passes through the points $P(1, 3, 2)$, $Q(3, -1, 6)$ and $R(5, 2, 0)$.
- (b) The temperature in degrees Celsius on the surface of a metal plate is given by $T(x, y) = 20 - 4x^2 - y^2$, where x and y are measured in centimeters.
(i) In what direction from $(2, -3)$ does the temperature increase most rapidly? What is the rate of increase?
(ii) A heat – seeking particle is located at the point $(2, -3)$ on the metal plate. Find the path of the particle as it continuously move in the direction of maximum temperature increase.
2. (a) Let $\mathbf{F}(x, y, z) = (e^{-y} - ze^{-x})\mathbf{i} + (e^{-z} - xe^{-y})\mathbf{j} + (e^{-x} - ye^{-z})\mathbf{k}$ be a vector field.
(i) Show that the vector field \mathbf{F} is exact.

- (ii) Evaluate the line integral $\int_{\gamma} \mathbf{F} \cdot d\mathbf{s}$, where γ is the path given by

$$\left. \begin{aligned} x &= \frac{1}{\ln 2} \ln(1+p) \\ y &= \sin \frac{\pi p}{2} \\ z &= \frac{1-e^p}{1-e} \end{aligned} \right\} 0 \leq p \leq 1$$

from $(0, 0, 0)$ to $(1, 1, 1)$

- (b) (i) Let $G(x, y, z) = \frac{1}{1+4(x^2+y^2)}$ and S be the portion of the paraboloid $z = x^2 + y^2$ between $z = 0$ and $z = 1$. Find the value of the integral $\iint_S G(x, y, z) dS$.

- (ii) The distribution of mass on the hemisphere shell $z = (R^2 - x^2 - y^2)^{\frac{1}{2}}$ is given by $\sigma(x, y, z) = \frac{\sigma_0}{R^2} (x^2 + y^2)$ where σ_0 and R are constants. Find an expression in terms of σ_0 and R for the total mass of the shell.

3. (a) (i) Evaluate the integral $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_{\sqrt{3(x^2+y^2)}}^{\sqrt{4a^2-x^2-y^2}} dz dy dx$

- (ii) Let S be the solid bounded by the cylinder $x^2 + y^2 = 4$, the plane $x + z = 6$ and the xy -plane. Use the divergence theorem to evaluate the integral $\iiint_S \mathbf{F} \cdot \mathbf{n} d\sigma$ where

$$\mathbf{F}(x, y, z) = (x^2 + \sin z)\mathbf{i} + (xy + \cos z)\mathbf{j} + e^y \mathbf{k}$$

- (b) (i) Calculate the surface area of the level set $x^2 - 2y - 2z = 0$ which projects onto the region Ω of the xy -plane bounded by the lines $x = 2$, $y = 0$ and $y = 4x$.
- (ii) Calculate the volume of the region U bounded above by the paraboloid $z = 9 - x^2 - y^2$, below by the xy -plane and which lies outside the cylinder $x^2 + y^2 = 1$.

Section II

Attempt any two questions from this section

4. (a) (i) Police plan to enforce speed limits by using radar traps at 4 different locations within the city limits. The radar trap at L_1 is operated 40% of the time, the one at L_2 is operated 30% of the time while the radar trap at L_3 is operated 20% of the time and the trap at L_4 is operated 30% of the time. If a person who is speeding on his way to work has probabilities 0.2 , 0.1 , 0.5 and 0.2 respectively, of passing through these locations, what is the probability that he will receive a speeding ticket?
- (ii) A commuter owns two cars, one a compact and the other a standard model. About three – fourths of the time he uses the compact to travel to work and about one – fourth of the time the larger car is used. When he uses the compact car he gets home by 17 : 30 about 75% of the time; if he uses the standard – sized car he gets home by 17 : 30 about 60% of the time. If he gets home after 17 : 30, what is the probability that he used the compact car?
- (b) (i) A fruit grower claims that $\frac{2}{3}$ of his peach crop has been contaminated by the medfly infestation. Find the probability that among 4 peaches inspected by this grower, less than 2 have been contaminated.
- (ii) To avoid detection at customs, a traveler has placed 3 narcotic tablets in a bottle containing 5 vitamin pills that are similar in appearance. If the customs official selects 2 of the tablets at random for analysis, what is the probability that the traveler will be arrested for illegal possession of narcotics?
5. (a) A continuous random variable has the following density function
- $$f(x) = \begin{cases} k(1+x), & 2 \leq x \leq 5 \\ 0 & \text{elsewhere} \end{cases}$$
- (i) Find the value of k .
- (ii) Find its cumulative distribution $F(x)$.
- (iii) Hence or otherwise find $P(3 < X < 4)$.

- (b) (i) A large industrial firm purchases several new typewriters at the end of each year, the exact number depending on the frequency of repairs in the previous year. Suppose that the number of typewriters, X , that are purchased each year has the following probability distribution

x	0	1	2	3
$f(x)$	0.1	0.3	0.4	0.2

If the cost of desired model will remain fixed at \$1200 throughout the year and a discount of $50X^2$ dollars is credited toward any purchase, how much can this firm expect to spend on new typewriters at the end of the year?

- (ii) In an inventory study it was determined that, on the average, demands for a particular item at a warehouse were made 5 times per day. What is the probability that on a given day this item is requested fewer than 3 times?

6. (a) The average life of a certain type of small motor is 10 years with standard deviation of 2 years. The manufacturer replaces free all motors that fail while under guarantee. If he is willing to replace only 3% of the motors that fail, how long a guarantee should he offer? Assume that the lives of the motors follow a normal distribution.
- (b) A soft – drink machine is regulated so that it discharges an average of 200 milliliters per cup. If the amount of a drink is normally distributed with standard deviation equal to 15 milliliters,
- (i) what fraction of the cups will contain more than 224 milliliters?
 - (ii) what is the probability that a cup contains between 191 and 209 milliliters?
 - (iii) how many cups will probably overflow if 230 milliliter cups are used for the next 1000 drinks?
 - (iv) below what value do we get the smallest 25% of the drinks?