CSCM53
COMPUTER SYSTEM CONCEPTS
(Attempt question 1 and either question 2 or 3)

Question 1 *(**This question must be attempted by all candidates**)*

a. Give the decimal values of the following 8-bit 2s complement numbers
  i 10101010
  ii 01001011 **[2 marks]**

b. How can overflow be detected in 2s complement arithmetic? **[1 mark]**

c. Briefly explain how *run-length encoding* works and encode the following string. Calculate the *compression ratio*.
  abcddddefffgghhhhhiijj **[5 marks]**

d. What is the role of cache memory in a modern CPU? **[1 mark]**

e. Give the Truth Table for a NAND gate and express it using a Boolean expression using only NOT, AND and OR . **[4 marks]**

f. Briefly explain how Huffman encoding works. **[3 marks]**

g. Briefly explain the function of an Operating System by listing *three* functions that it must perform. **[3 marks]**

h. Briefly explain the differences between the following types of network routing
  i Circuit switching
  ii Virtual circuits
  iii Packet switching **[3 marks]**

i. What can be considered the three main aspects of information security?**[3 marks]**

Question 2   *(Attempt either this question or question 3)*

   a. What is a floating point number? Briefly explain how a floating point number is typically represented in binary. How might infinity be represented in the floating point representation you have described?   **[7 marks]**

   b. "All data is simply binary". Discuss the various ways in which binary data can be interpreted to represent:
       i   Audio
       ii   Line Diagrams
       iii Photographic Images
       iv   Video

                                                                           [8 marks]

   c. Describe the standard *execution cycle* of a processor. What factors can influence the processing speed of a computer system as perceived by the user and briefly discuss what techniques can be used to improve the speed? Include in your answer both hardware and software approaches.   **[7 marks]**

   d. Compare and contrast timesharing and multiprogramming.   **[3 marks]**

Question 3   *(Attempt either this question or question 2)*

a. Draw a finite state machine that can recognise a number in a high-level programming language where a number is defined as starting with an optional sign (+ or -) followed by digits (0..9) and optionally a decimal point (.) and another series of digits (0..9) and explain how it works.   **[6 marks]**

b. What are the main differences between wired and wireless networks? Your answer should indicate what additional problems are associated with wireless networks and how they can be dealt with.   **[4 marks]**

c. What is the relationship between a paged memory system and the file management system? Briefly explain how files can be stored using *contiguous*, *linked* and *indexed* management systems. What are the advantages and disadvantages of each approach?
                                [6 marks]

d. Outline how a typical computer disk is organised in terms of tracks, sectors, blocks and cylinders. Using as an example the following sequence of ordered cylinder requests for disk access explain how *First-Come First-Served (FCFS)*, *Shortest-seek-time-first (SSTF)*, and *Scan* scheduling algorithms operate assuming that initially the read/write heads are at cylinder 23 moving away from cylinder 1.

35 33 12 15 49 81

                                [9 marks]