CHUKA  UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE, COMPUTER SCIENCE & APPLIED COMPUTER SCIENCE

COSC 333: DESIGN AND ANALYSIS OF ALGORITHMS

STREAMS: BSC (COMP.SCI) & BSC (APPLIED. COMP SCI) Y3S2 TIME: 2 HOURS

DAY/DATE: THURSDAY 11/4/2019 8.30 A.M. – 10.30 A.M.

INSTRUCTIONS

- Answer **QUESTION 1** and any other **TWO QUESTIONS** from section B.
- This is a CLOSED BOOK EXAM, No reference materials allowed.
- No use of mobile phones
- Write you answer legibly and use your time wisely.
- Scientific non programmable calculators may be used

SECTION A: COMPULSORY
QUESTION ONE (30 MARKS)

a Discuss approaches to the design of computer algorithms [4 marks]
b Explain the basic elements that characterize dynamic programming [2 marks]
c When is the greedy approach desirable in designing algorithms [4 marks]

d Explain how insertion sort algorithm works and derive its time complexity. [6 marks]
e Analysis of algorithms means predicting the resources that the algorithm requires. Discuss. [6 marks]
f Explain the order of growth of algorithms. Your discussion should be based on the worst case, the best case and average case running time. [2 marks]
g Dynamic programming is not applicable to all optimization problems. Discuss the characteristics that a problem should have for dynamic programming to be applicable. [6 marks]

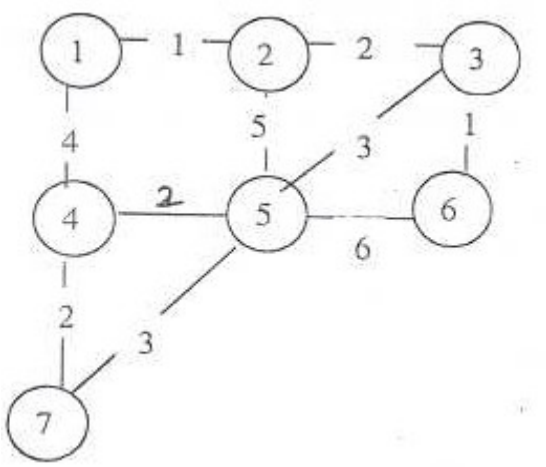
SECTION B: (CHOOSE ANY TWO QUESTIONS FROM THIS SECTION)
QUESTION TWO

a. A Palindrome is a non-empty string over some alphabet that reads the same forwards and backwards. Examples of palindromes are all string of length 1, civic, racecar and aibohphobia (fear of palindromes).

   (i) Give an efficient algorithm that finds the longest palindrome that is a subsequence of a given input string. i.e. Given the input "CHARACTER", your algorithm should return "CARAC" [5 marks]

   (ii) Analyze the running time of the algorithm above and give the best case and worst case running time [5 marks]

b. Find the minimum spanning tree for graph shown below using Kruskal's and Prim's algorithm [10 marks]

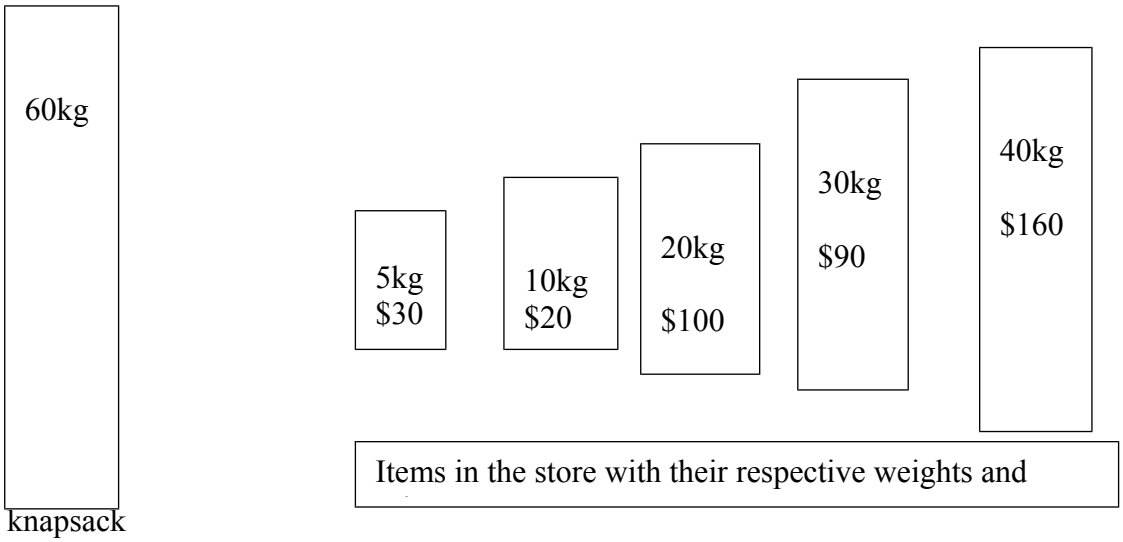


QUESTION THREE (20 MARKS)

a. Discuss the nature of divide and conquer algorithms and give examples of algorithms that utilize this technique in solving computer problems [8 marks]

c. A thief is robbing a store, where he finds a number of items to be taken. Each item is worth certain dollors and has got some weight. The thief is carrying a Knapsack that can only accommodate a maximum weight of 60Kg.

Use the illustrations below to answer the questions that follows:



What is the maximum value of goods that the theif can carry if he assumes the following:

(i) Gready solution to fractional problem [4 marks]

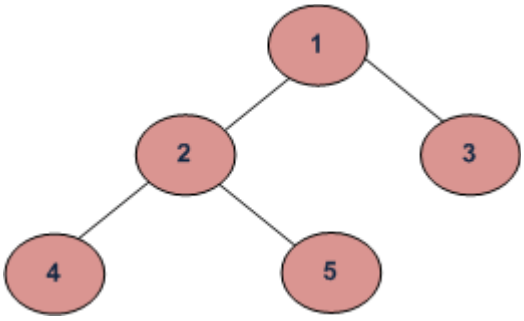
(ii) Gready solution to 0-1 problem [4 marks]

(iii) Optimal solution to 0-1 problem [4 marks]

QUESTION FOUR (20 MARKS)

a. Explain the application areas of binary trees [2 marks]

b. Determine the traversals of the following binary tree in the order given



(i) Inorder [4 marks]

(ii) Preorder [4 marks]

(iii) Postorder [4 marks]

c. If a binary search tree is formed from the sequence 6, 9, 1, 2, 7, 14, 12, 3, 8, 18. Determine the minimum number of nodes required to be added in to this tree to form an extended binary tree. [6 marks]

QUESTION 5 [20 MARKS]

(a) Given a Chain of matrices with their dimensions shown: A1=30X35, A2=35X15, A3=15X5, A4= 5X10, A5=10X20, A6=20X25. Determine the optimal sequence for multiplying this matrix. [12 marks]

(b) With the use of dynamic programming, find the Longest common subsequence for the sequences X = {ABCBDAB} and Y = {BDCABA}, Use tables to illustrate your workings and how you achieve the final answer [8 marks]
