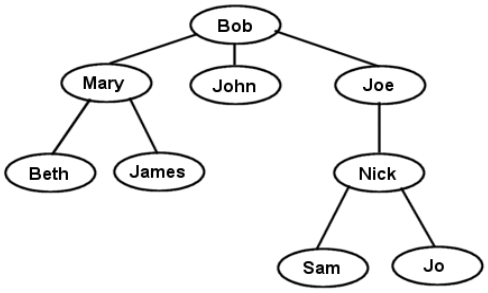
Department of Computer Science and Engineering
FINAL EXAMINATION, Summer' 18
CSE 221: Algorithms
Total Marks: 50 Time Allowed: 2.00 Hour
[Answer any 5 questions]

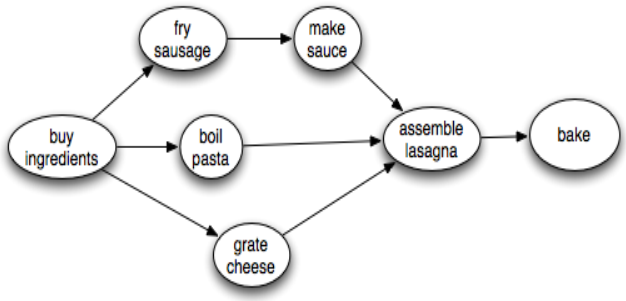
Student ID : **Name:**

Question 1: **[4+4+2=10]**

(i) You are given your family tree. Suppose, you are Sam. Nick is your immediate ancestor. You have to find out your 3rd ancestor starting from you. Now, which searching algorithm would be efficient here? Justify your answer and apply the algorithm on the figure below.



(ii) Suppose you want to make pasta for yourself. You, have a set of tasks to perform to make pasta, but some tasks have to be done before other tasks can start. In what order should you perform the tasks so that you can prepare pasta successfully for yourself ? The tasks dependency are given below :



(iii) What is the time complexity of your algorithm applied for (i) and (ii) ? Explain your answer.

Question 2: **[4+2+4=10]**

(i) Consider you have coins, c = {1, 3 , 4} and you have to make a change for, **M** = 10 using minimum number of coins by applying a dynamic programming technique. You can assume that you can take any coin infinite number of times.

(iii) Suppose, you have $6 to buy food for a day. There are several options, but you need to maximize total calories from the food for longer survival. Apply dynamic programming technique to choose the food items so that you can have maximum calories from the given amount of money?[You cannot eat an item partially]

Item	Price	Calories
Cheese Burger	$3	250 cal
Pizza	$4	295 cal
Chicken fry	$3	225 cal
Fried rice	$2	290 cal
Salad	$1	180 cal

(ii) What is the time complexity of your applied algorithm in (i). What would happen if you applied brute-force approach?

Question 3: **[2+5+3=10]**

(i) Is Heap a complete binary tree? Justify your answer with an example.

(ii) Build a MinHeap for the below array. Show every step clearly. What would be the time complexity to construct a heap?

36	8	12	67	2	10	15	18

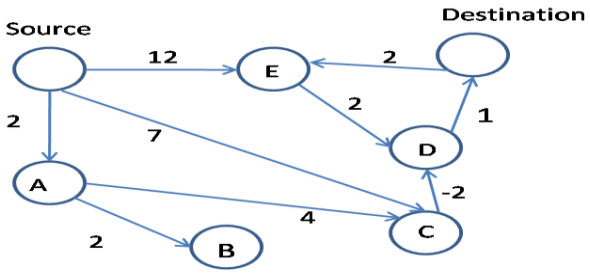
(iii) Insert "5" in your constructed MinHeap maintaining the heap property.

Question 4: **[2+6+2 = 10]**

(i) What are the conditions needed for an algorithm to be called Greedy?

(ii) Given the following map along with their paths. The weights of the edges represent the traffic level between 2 areas. Find out, using the suitable algorithm, the shortest time you need to reach destination from source.

(iii) Write the time complexity of your applied algorithm.



Question 5: **[6+4= 10]**

Encode the following text using **Variable Length Coding** Scheme: "Avada Kedavra"

(i) You need to apply the **Huffman coding technique**. Construct **Huffman Tree** and generate the codeword for each character.

(ii)Encoding the text using Huffman strategy, count the total number of bits required to store the file.

[Answer in Question Paper, Except the tree construction]

Characters	Frequency (F)	CodeWord (C)	Length of Codeword (L_c)	F x L_c	Encoded Text
A	1				
v	2				
a	4				
d	2				
K	1				
e	1				
r	1				
_ (space)	1				
	13			=?	

Question 6: **[1+4+2+3=10]**

(i) Given 2 DNA sequences, "A28BX3" and "2XBX13," how much time would you need if you had to find the Longest Common Subsequence using Brute Force?

(ii) Apply an efficient algorithm to find the LCS from the above sequences.

(iii) Explain the differences between Bottom Up and Top Down dynamic programming?

(iv) Using simple diagrams explain forward edge, back edge and cross edge.

Question 7: **[8+2=10]**

You are given an n-by-n grid, where each square c[i, j] contains the number of gold coins. Assume that c[i, j] ≥ 0 for all squares. You must start in the upper-left corner and end in the lower-right corner, and at each step you can only travel one square down or right. When you visit any square, including your starting or ending square, you may collect all of the coins on that square.

(i) **Give an algorithm** to find the **maximum number** of coins you can collect (show the simulation of your algorithm using an example).

(ii) Analyze the time complexity of your algorithm