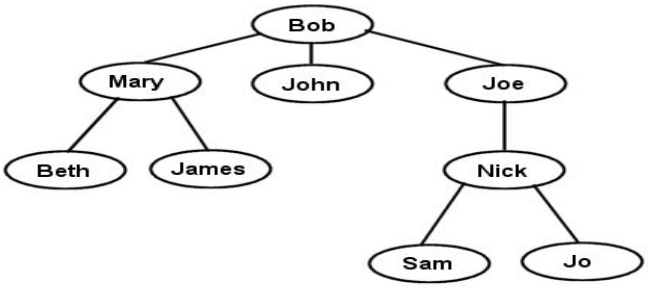
Department of Computer Science and Engineering
FINAL EXAMINATION, Fall' 18
CSE 221: Algorithms
Answer any 5
Total Marks: 50 Time Allowed: 2.00 Hour

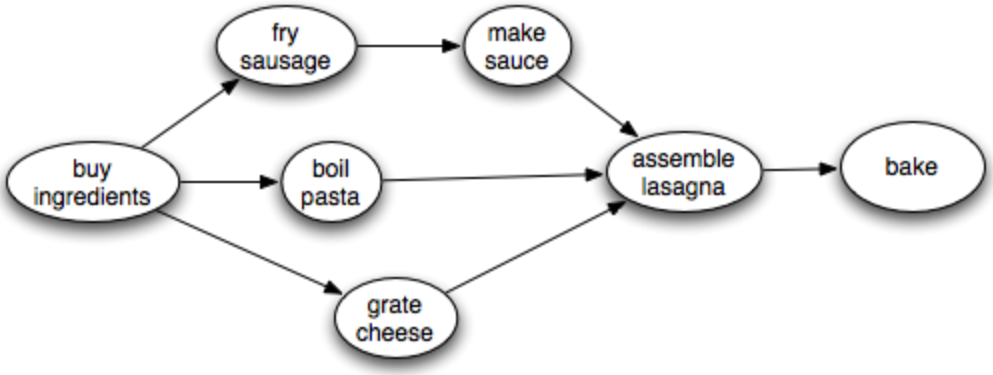
Student ID : **Section :** **Name:**

Question 1: [3+5+2= 10]

(i) You are given your family tree. Suppose, you are Sam. Nick is your immediate(or first) ancestor. You have to find out your 3rd ancestor starting from you. Which algorithm would be efficient here? Justify your answer with clear explanation and simulation.



(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 algorithms applied for (i) and (ii) ? Explain your answer.

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

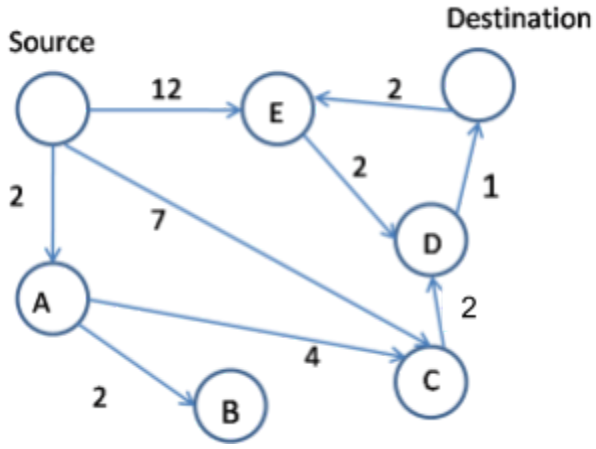
Suppose, you have $10 to buy food for a day. You have several options, but you need to maximize total calories from the food items for longer survival. Apply dynamic programming technique to choose the items so that you can have maximum calories from the given amount of money.You are not allowed to waste any food, so if you choose an item, you will eat it completely.

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

(i) Apply dynamic programming technique to find the maximum calorie you can eat.
(ii) Write and simulate the algorithm to find the selected items for optimal calorie intake within $10.
(iii) Analyze the time complexity of your algorithm in (ii).

Question 3: [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 suitable algorithm, the shortest time you need to reach destination from source.
(iii) Write the time complexity of your applied algorithm.



Question 4: [6+4= 10]

Encode the following text using **Variable Length Coding** Scheme.

"Hello All "

(i) Variable Length Coding (VLC): You need to apply the **Huffman coding technique** which ensures the optimal prefix coding system. Construct **Huffman Tree** and generate the codeword for each character.
(ii) After encoding the text using Huffman strategy, count the total number of bits required to store the file.

Characters	Frequency (F)	CodeWord (C)	Length of Codeword (L_c)	F x L_c =?	Encoded Text
H	1				
e	1				
l	4				
o	1				
A	1				
_ (space)	1				
	=9			=?	

Question 5: [1+4+3+2= 10]

Consider you have coins, c = {5, 4, 1} and you have to make a change for, **M** = 12 using minimum number of coins by applying a dynamic programming technique. You can assume that you can take any coin infinite number of times.
(i) Write the recurrence equation for the above problem
(ii) Find out the minimum number of coins using the dynamic programming technique. The solution should be simulated clearly.
(iii) What is the optimal combination of coins? Explain and Simulate the algorithm to find the optimal combination.
(iv) What is the time complexity of your applied algorithm in (ii). What would happen if you applied brute-force approach?

Question 6: [10]

Execute the operations in sequence listed in the following table and fill-up the columns correctly. For collisions resolution use Linear Probing method. Assume that you have 11 buckets and first bucket is indexed at 0. **[Answer in Question Paper]**

Value:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Table:

0	1	2	3	4	5	6	7	8	9	10

SL NO	Operations	Hash function (Key) = ?	Collision =Yes/No	Position of **Allotted/ Searched/Deleted** Bucket Use "False" if any operation fails	No. Of Buckets to lookup
1	insert(HELLO)	(8+5+12+12+15)%11 = 8	No	8	1
2	insert(HEL)	(8+5+12)%11 = 3	NO	3	1
3	insert(EHL)	(5+8+12)%11 = 3	Yes	4	2
4	search(HELL)	(8+5+12+12)%11 = 4	Yes	False	11
5	delete(HELLO)	(8+5+12+12+15)%11 = 8	No	8	1
6	insert(CLASS)				
7	insert(EXAM)				
8	insert(HARD)				
9	insert(PASS)				
10	delete(PASS)				
11	insert(GIRL)				
12	search(EASY)				
13	insert(HELL)				
14	insert(BOY)				
15	delete(FAIL)				