

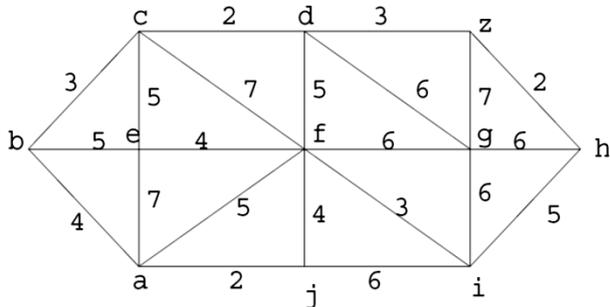
Discrete Mathematical Structure Final Exam (Spring 2013)

No :

Name:

GRAPHS

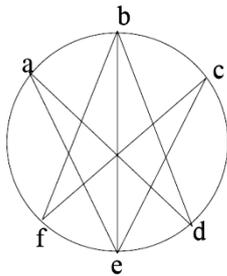
1. (15P) Use Dijkstra's algorithm to find the length of a shortest path and a shortest path from a to z in the following weighted graph (show each iteration in below box).



a	b	c	d	e	f	g	h	i	j	z
0	-	-	-	-	-	-	-	-	-	-
0	4	-	-	7	5	-	-	-	2	-
0	4	7	10	7	5	11	-	8	2	-
0	4	7	9	7	5	11	13	8	2	-
0	4	7	9	7	5	11	13	8	2	12

The length of the shortest path is 12.

2. (10P) For the following graph, determine if it has an Euler path that is not a circuit.

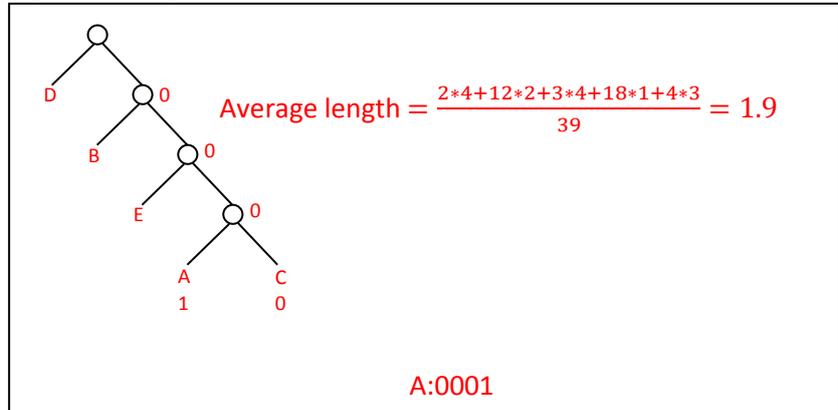


It has an Euler trail that is not a circuit because it has two vertices with odd degree (b and e).

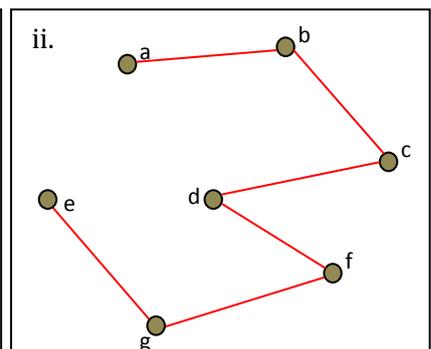
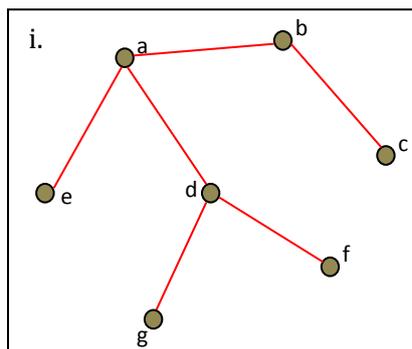
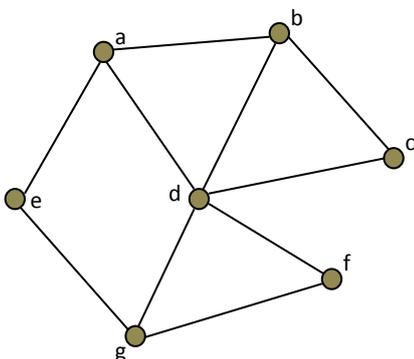
TREES

3. (15P) Construct an optimal Huffman code for the set of letters in the table. Find the average length of bit strings encoding 39-letter words with the Huffman code.

letter	frequency
A	2
B	12
C	3
D	18
E	4

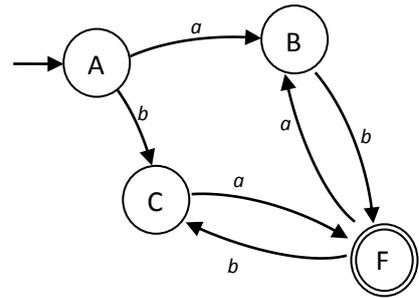


4. In the following graph with its vertices in alphabetical order find a spanning tree using
- i. (10P) Breadth-first search.
 - ii. (10P) Depth-first search.



AUTOMATA

1. According to finite state automaton transition diagram given on the right,
 - i. (10P) Design the grammar rules.
 - ii. (10P) Describe acceptable strings as a sentence.



i. $A \rightarrow aB \mid bC$ $B \rightarrow bF$ $C \rightarrow aF$
 $F \rightarrow aB \mid bC \mid \lambda$

Then by removing λ ,

$A \rightarrow aB \mid bC$ $B \rightarrow bF \mid b$
 $C \rightarrow aF \mid a$ $F \rightarrow aB \mid bC$

ii.

The strings which start and finish with the different symbols, where the same letters cannot be consecutive, are accepted.

2. Let G be the grammar of a language with non terminal symbols {E,F}, terminal symbol {a,b,+,*}, starting symbol E, and rules as follow.

$$E \rightarrow F \quad E \rightarrow +FE$$

$$E \rightarrow *FE \quad F \rightarrow a$$

$$F \rightarrow b$$

- i. (10P) Find a derivation for the string " * +a * bba" .
- ii. (10P) Draw its deterministic finite state automaton transition diagram by using non-deterministic one.

i.

It cannot be possible to derivate that string " * +a * bba" by using G grammar.

