Computer Sciences
University of Technology

Date: 5/6/2012
Time: 3 hours
Lecturer: akbas Ezaldeen

Final Exam. 2011-2012
First trail

Subject: Discrete Mathematics
Class: first
Branch : *Sw, Net, & Scu.*

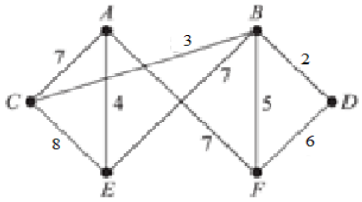
Note: Answer (6) questions only , 10 marks for each.

Q1) Prove by induction (for n = 1) : $1 + 4 + 7 + \ldots\ldots + (3n - 2) = 1/2\ n\ (3n - 1)$

Q2) for the following relations on the set $A = \{1, 2, 3\}$:
$R = \{(1, 1), (1, 2), (1, 3), (3, 3)\}$, & $Q = A \times A$ = the universal relation
Determine if R & Q is:
(a) reflexive; (*b*) symmetric; (*c*) transitive; (*d*) antisymmetric.

Q3) Sketch the graph of the g: R→R where **$g(x) = x^3 + 5$**
Is g(x) : 1) Function?
2) One-to-one?
3) Onto? (Mention the reasons)

Q4) Find minimum spanning tree and its weight for the following graph using Kruskal algorithm



Q5) In a survey of 100 students produced the following:
32 study mathematics
20 study physics
45 study biology
15 study mathematics & biology
7 study mathematics & physics
10 study physics& biology
30 do not study any of the three subjects
(a) Find the number of students studying all three subjects?
(b) Fill in the correct number of students in each of the eight regions of the Venn diagram.

Q6) Consider the algebraic expression: **(6 - (2 + (6 / 3))) * ((5 - 2) + 1)**
1- Rewrite the expression into prefix polish notation form
2- Draw the corresponding ORT
3- Evaluate the value of the expression in prefix polish notation form

Q7) **design** a finite state machine that recognizes the sequence pattern ***"ab"*** in the input string $x \in A^*$.
Where the input $A = \{a,b\}$, and the output $Z = \{0, 1\}$.
Trace the input string $x \in A^*$: X = a a **a b** b **a b a b**

الاجابة :

Q1) (i) n =1 ; P(1) : left side = 3*1 -2 = 1
Right side = (½ *1 * 3 - 1 = 1

(ii) let P(k) is true ; n=k

$1 + 4 + 7 + \ldots\ldots + (3k - 2) = \frac{1}{2} k (3k - 1)$

to prove that P(k+1) is true, we add $3k - 2 + 3 = 3k+1$

$1 + 4 + 7 + \ldots\ldots + (3k - 2) + (3k+1) = \frac{1}{2} k (3k - 1) + (3k+1)$

$$= \frac{k (3k - 1) + 2 (3k+1)}{2}$$

$$= \frac{3k2 - k + 6k+2}{2}$$

$$= \frac{3k2 + 5k+2}{2}$$

$$= \frac{(k+1)(3k+2)}{2}$$

$$= \frac{1}{2} k (3k - 1)$$

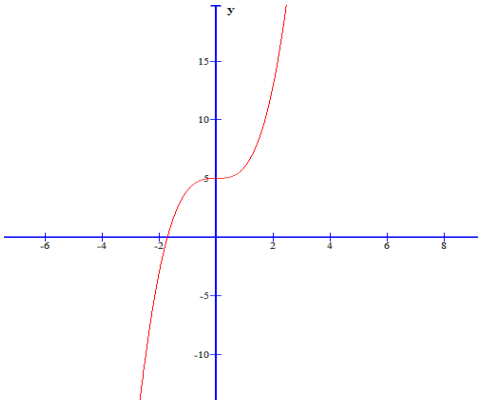
So P is true for all $n \geq k$

Q2) R: a) not reflexive
b) not symmetric
c) transitive
d) antisymmetric

Q: a) reflexive
b) symmetric
c) transitive
d) not antisymmetric

Q3) $g(x) = X^3 + 5$

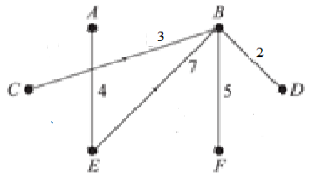
x	g (x)
-3	-22
-2	-3
-1	4
0	5
1	6
2	13
3	32



1) function? Yes
2) One-to-one? yes
3) Onto? Yes

Q4)

Edges :	BD	CB	AE	BF	DF	BE	Af	CA	CE
	2	3	4	5	6	7	7	7	8
Add?	Yes	yes	yes	yes	no	yes	no	no	no



Q5) a- 100 – 30 =70

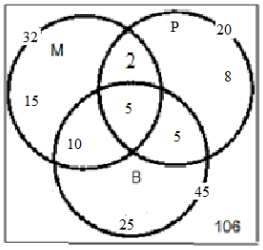
$|M \cup P \cup B| = |M| + |P| + |B| - |M \cap P| - |M \cap B| - |P \cap B| + |M \cap P \cap B|$

70 = 32 + 20+ 45 - 7 - 15 - 10 + $|M \cap P \cap B|$

70 = 65 + $|M \cap P \cap B|$

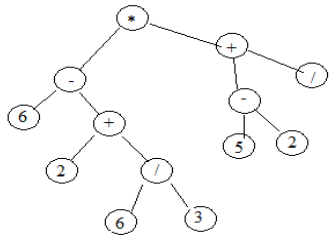
$|M \cap P \cap B| = 70 - 65 = 5$

b-



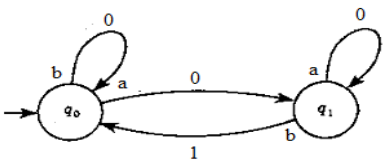
Q6) 1) * - 6 + 2 / 6 3 + - 5 2 1

2)



3) = * - 6 + 2 / 6 3 + - 5 2 1
= * - 6 + 2 2 + 3 1
= * - 6 4 4
= * 2 4
= 8

Q7) aaabbabab



Output = 000100101