CS21001:Discrete Structures

Autumn semester 2009-10

Class test 2

Name: **Roll no.:**

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1. Consider the relation R on $A = \{1, 2, 3, 4\}$ given by the matrix

$$M_R = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Is R a partial order? Why or why not? **(2)**

2. Let R be a relation with $R \subset A \times A$ where $A = \{a, b, c, d, e\}$. Answer the following questions with justification.

(a) Give an example of a non-empty relation that is both symmetric and anti-symmetric. **(2)**

(b) How many relations R are symmetric? **(2)**

3. You are given the following pseudocode:

```
procedure foo(n, m:  natural numbers)
     if(m = 0) return 1
     else return n*foo(n, m - 1)

procedure bar(n:  natural number)
     p:= 0
     for i := 0 to n
          p := p + foo(n, 3)
     return p
```

(a) Describe the output of `foo` as a function of the inputs n and m **(2)**

(b) Describe the output of `bar` as a function of the input n. Give your answer as a summation and also in closed form(equation that doesn't involve summation). **(2)**

4. **(a)** Let $A = B = \{a, b, c\}$. Consider the relation $g = \{(a, b), (b, c), (c, c)\}$. Is g one-to-one? Is g onto? Why? **(2)**

(b) Is $(A, \leq)$ a lattice? Why or why not? **(2)**

5. Give the Hasse diagrams for all the non-isomorphic lattices that have five elements. (There are five of them) **(3)**

6. Suppose that $a^2 = 1$ for each element a in a group G. Show that G is abelian. **(3)**