



### SCOPE

CSE 2003 DATA STRUCTURES AND ALGORITHMS Slot: G1

Answer All the Questions

Time: 90 minutes

$5 \times 10 = 50$

Max. Marks: 50

1. a) You have been hired as a consultant for a firm. You are told that the firm faces two types of customers (an equal number,  $n$ , of each type; thus there are  $n$  type 1 and  $n$  type 2 consumers). One type of customers have the following with inverse demand  $P = 33 - 2Q$  while the other type has inverse demand  $P = 25 - Q$ . The firm's cost function is given by  $C(Q) = Q$ . The firm cannot tell which customer belongs to which type. It has been suggested to the manager that one of the following pricing policies should be adopted and you are asked to decide which one maximizes the firm's profits. You have to prepare a report explaining your recommendation. Your report must specify for every pricing policy what each type of consumer would choose and what the firm's profits would be.

POLICY 1: charge a uniform price of \$17 per unit.

POLICY 2: charge a uniform price of \$13 per unit.

POLICY 3: offer two different packages. Package 1 is sold for \$220 and contains 12 Units. Package 2 is sold for \$136 and contains 8 units.

POLICY 4: offer two different packages. Package 1 is sold for \$264 and contains 16 Units. Package 2 is sold for \$243 and contains 12 units.

- Write an algorithm to fulfil the firm's policy.
- Give the proof of correctness for the same.

- ✓ b) Consider two players: Alice and Bob. Alice moves first. At the start of the game, Alice has two piles of coins in front of her: one pile contains 4 coins and the other pile contains 1 coin. Each player has two moves available: either "take" the larger pile of coins and give the smaller pile to the other player or "push" both piles across the table to the other player. Each time the piles of coins pass across the table, the quantity of coins in each pile doubles.

For example, assume that Alice chooses to "push" the piles on her first move, handing the piles of 1 and 4 coins over to Bob, doubling them to 2 and 8. Bob could now use his first move to either "take" the pile of 8 coins and give 2 coins to Alice, or he can "push" the two piles back across the table again to Alice, again increasing the size of the piles to 4 and 16 coins. The game continues for a fixed number of rounds or until a player decides to end the game by pocketing a pile of coins. The addition of coins is taken to be an externality, as it is not contributed by either player.

✓ Write an algorithm for the above problem. Give the proof of correctness for the same.

✓ 1. Write a pseudo code to implement the procedure of stack operations using array. Operations must include Push, Pop, Isempty, Isfull, number of elements, Display.

✓ 2. Write the pseudo code to implement a queue. (All the operations of queue should be implemented)

✓ 3. Convert the infix expression  $B \wedge C / D + (E + A) / K \wedge C$  to prefix notation.  
Note:  $\wedge$  represent exponentiation operation  $\wedge / + \wedge BCD + EAKC$

5. You maintain a linear list in array, circle [MAX\_SIZE]. You set up front and rear indices similar to those used for a circular queue. Write pseudo code for the following.

- i) Obtain a pseudo code in terms front, rear and MAX\_SIZE for the number elements in the list.
- ii) Deletion of  $m^{th}$  element in the list.
- iii) Insert an element, immediately after the  $m^{th}$  element.