



DURATION: ONE AND HALF HOURS

Date: 10.02.2006

Time: 4.00 pm to 5.30 pm

Answer ALL questions.

Q1.

- i. What is an abstract data type (ADT)?. Describe in your own words with the help of an Example.
Discuss the properties of an abstract data type by using an example.
(Note: Do not copy directly from the book).
- ii. Design an abstract data type (ADT) for fractional numbers named as *Fraction* which describes the properties of fractions.
 - a). What is the data structure that can be used for this purpose and what are its elements (fields)?.
 - b). Briefly explain why *Fraction* can be considered as an ADT. For an instance, use adding two fractional numbers.
- iii. Briefly explain with suitable diagrams, how you can insert a new cell and delete an existing cell containing a new element to a pointer-based list data structure.
- iv. Compare and contrast the doubly linked list data structure with singly linked list data structure.
- v. Suppose a list contains the following elements:
12, 18, 25, 10, 13, 15, 20, 16
Write a Pascal procedure to delete the element with value 13. You should clearly state all the assumptions you make.

Q2.

- i. Compare and contrast the list data structure with stack data structure.
- ii. Discuss how you can transform a list data structure into a stack data structure?.
- iii. Write a Pascal function to delete an item in the stack data structure. That function should check whether the stack is empty and delete the item at the top of the stack data structure.
(Note: with suitable diagrams clearly indicate the current position of the first stack item, before and after the deletion operation by using the indicator *top*).
- iii. Briefly explain the disadvantages of an array-based stack data structure compared to linked stack structure.
State how you can overcome the above disadvantages in the linked stack structure.

Q3.

- i. Briefly explain the queue data structure in your own words with suitable diagrams.
- ii. Write a Pascal function to check whether the queue is full with elements.
- iii. Write a Pascal program segment (procedure/function) by using the above function (function in Q3 part ii) to insert a character element y into a circular queue (q).
- iv. Usually in circular queues we do not allow the queue to grow longer than $maxlength-1$. Discuss whether it is necessary to limit the length of a queue to $maxlength-1$?

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