NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
MAY EXAMINATIONS 2002

SUBJECT: PROGRAMMING AND PR0GRAM DESIGN
CODE: SCS1201

INSTRUCTION TO CANDIDATES
1. Answer any FOUR questions
2. All questions carry equal marks [25 each]

Time: 3 hours

QUESTION ONE

a) What are formal specification languages? [5]

b) What are the main advantages of formal languages over informal languages of specification? [10]

c) In model based specifications we have implicit and explicit specifications, what are the main differences between these methods. [5]

d) State and explain the two main requirements of a formal system. [5]

QUESTION TWO

a) Which of the following names are valid Z user-defined identifiers? If not explain why not.
First_name, airport?, report!, b_3,last-name, _data, !st_field [6]

b) A queue is a data structure in which elements can be added (enqueue) and extracted (dequeue). Queues are FIFO structures where the first element to be placed on the queue, is the first element to be taken from it

i) **Define queue as a state variable**

ii) Define the initial state of the queue as empty

iii) Define the operations Enqueue and Dequeue [14]

QUESTION THREE

a) What is the importance of program design? [5]

b) What are the main requirements of software design methods? [5]

c) Briefly describe the characteristics and main stages of JSP [10]

d) What are the advantages of JSP? [5]

QUESTION FOUR

a) Air NUSTY wishes a Booking system specified in Z notation. The system requires the following operations be defined in Z notation.

i) Booking Limit

ii) Overbooked

iii) Add_booking [15]

b) Assuming the following schemas have been defined

Bookings

flight?:FLIGHT_NO
passengers:NAME→FLIGHT_NO
number_of_bookings: **N**

---

number_of_bookings=#(dom(*passengers*▷{*flight?*}))

and

AirCraft_seating

flight?:FLIGHT_NO
number_of_seats: FLIGHT_NO→SEATING_CAPACITY
max_seating_capacity: **N**

---

max_seating_capacity = *number_of_seats* (*fligh?t*)

Redefine your operations in (a) above using schema inclusion. [6]

c) State the pre-condition of the following schema:

Logon

SYSTEM
name? :NAME
report! :STATUS

---

name?∈ *allowed*
name? ∉ *logged_on*
#*logged_on*<*max_capacity*
logged_on'= *logged_on*∪{*name?*}
report!=ok

[4]

QUESTION FIVE

A product file is contains a number of product records. Each record contains an area code, a district record, product code and a value. The file is sorted into product within district within area. A program is required to select certain product codes and produce a report showing district and area codes and produce a report showing district and area totals of the values of selected products in the order implied by the product file. Using JSP,

a) Sketch sample data for both input and output files and annotate the sketches to indicate groupings, repetitions and selections. [8]

b) Produce logical data structures for both input and output files, and indicate any correspondences between data structures. [8]

c) Derive a program structure from the logical data structures. [9]

QUESTION SIX

a) With the aid of diagrams explain the main differences between the "object-oriented design " and "data-oriented design" models? [5]

b) Using examples define the following terms as used in OOD:

i) encapsulation

ii) methods

iii) classification

iv) communication

v) attributes [10]

c) Given the object Class, Furniture, which has the following attributes: Cost, Dimension, Weight, Location and Color; as well as the following methods: Buy, Sell, Weigh, Move. By use of appropriate diagrams explain the concept of an object and inheritance (you may take the example of chairs, and tables). [10]

QUESTION SEVEN

a) What is an algorithm? [3]

b) Write the algorithm for computing *e,* given that

$$e = \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \frac{1}{5!} + \frac{1}{6!} + \frac{1}{7!} + \frac{1}{8!} + \frac{1}{9!} + \frac{1}{10!}$$ [10]

c) Draw a flow chart for this algorithm. [12]

END OF QUESTION PAPER

GOOD LUCK!