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

SUBJECT: **PROGRAMMING AND PROGRAM DESIGN**
CODE: **SCS 1201**

Instructions to candidate:

1. Answer **all** questions in Section A and **one** question from Section B

3 HOURS

SECTION A

QUESTION ONE

a) State giving advantages of formal methods in system specification. [8]

b) Define the following terms.

    i. Set

    ii. Predicate

    iii. Tuple

    iv. Function

    v. Relation

    vi. State Scheme

[12]

QUESTION TWO

Camp Energy is a holiday play scheme for children catering for 5 to 16 years olds. For each day of the camp, children may attend a morning session, an afternoon session or both. Before being booked into any session a child must be formally registered in the system. In practice this will involve the child's parent or guardian filling in a form with various details about the child and telephone number in case of emergency.

During each camp session the children are divided into groups. Children in any one group must all have ages within the same band according to:

Band	Lower Limit	Upper Limit
1	5	7
2	8	9
3	10	11
4	12	16

An adult leader is assigned to each group. Each leader must be registered with the scheme, following satisfactory completion of all application and acceptance procedures.

A leader can look after a maximum of 18 children from band 1 and maximum of 15 in each of the other age bands.

So, if 20 children of 8 or 9 years enroll for a particular session, two band 2 groups would need to be set up. There is also an overall figure set for the maximum number of children allowed at any one session. No more than 250 children may be in the camp session.

You are required to model the registration and booking system of Camp Energy. [20]

QUESTION THREE

The word for word system is intended to help the acquisition of vocabulary by a student learning a foreign language. The system is to record pairs of words, where one word is a native language word and the other is a foreign language word, where each word of a pair may serve as a translation of translation of the other, at least in some circumstances. Words to be added to the vocabulary must satisfy rules, known as the orthographic rules, which are concerned with spelling conventions in the two languages; the purpose of these rules is to eliminate as far as possible the addition to the vocabulary of words which could not possibly belong to the respective languages. The facilities to be provided are as follows:

a) Valid pairs of words may be added to the vocabulary.

b) All translations of a native word into the foreign language may be requested.

c) All translations of a foreign word into the native language may be requested.

In all cases, the system will report all detected errors in words submitted for entry into the vocabulary.

Develop a specification of the system passed on formal method.

Hint:

  i.   State the Given set and Global Definition

  ii. Initialization of the system.

  iii. The operational schemes for the system.

[20]

QUESTION FOUR

Give a detailed Analysis of the structure of a Specification Document based on formal method specification. [20]

SECTION B

QUESTION FIVE

Use truth tables to prove the following equivalencies.

1. $(p \Rightarrow q) \Leftrightarrow (7p \vee q)$ [4]

2. $(p \wedge q) \wedge r \Leftrightarrow p \wedge (q \wedge r)$ [4]

3. $(p \vee q) \wedge r \Leftrightarrow (p \wedge r) \vee (q \wedge r)$ [4]

4. $(-p \Rightarrow 7p) \Leftrightarrow (p \Rightarrow q)$ [4]

5. $(p \Rightarrow r) \wedge (q \Rightarrow r) \Leftrightarrow (p \vee q \Rightarrow r)$ [4]

QUESTION SIX

Supply Arguments for the rules.

1. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ [5]

2. $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ [5]

3. $A \backslash (B \cap C) = A \backslash B \cup A \backslash C$ [5]

4. $(A \cap B) \cup (A \backslash B) = A$ [5]

END OF QUESTION PAPER

GOOD LUCK!