UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

MAIN EXAMINATION 2008

Titles of paper: **SOFTWARE ENGINEERING – I** and
SOFTWARE ENGINEERING FOR B.ENG.

Course numbers: **CS451** and **CS461**

Time allowed: 3 hours

Instructions: Answer question 1 and any 4 of the remaining 5 questions. Each question carries 20 marks.

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Question 1 (Compulsory)

Carefully read the following information and answer questions a), b) and c) further below

1. The nation of Anarchia is considering establishing a new system of electronic governance whereby any newly proposed law put forward by the government will require the consent of the majority of voters in an election in order to be passed. It is envisioned that the citizens of Anarchia will be able to use special computer voting machines (or booths) located at public places nationwide.

2. Booths will display details about laws currently proposed by the government. In addition, Anarchian citizens will be able to cast votes from any booth, by selecting one or more proposals they intend to vote on, and indicating their yes-or-no decision on each one.

3. All the booths will be connected in a network with a central computer (known as the Server) located at the headquarters of the elections authority. Whenever the government drafts a new law, the text of the proposed law will be distributed by the Server to all the booths. Then there will follow a voting period of 500 hours during which votes may be cast at the booths and relayed to the Server for verification and counting.

4. At the end of the voting period of any proposed law, the Server will transmit the total number of yes and no votes for the law to each booth so that the decision of the majority can be displayed to the public.

5. Each voter will be issued with a unique ID number and a secret password. For purposes of identifying voters and preventing fraud, a database of registered voters will be made available to the Server. During the voting period for a proposal, each voter is permitted to cast multiple votes on that proposal (i.e. change his/her mind), in which case only the voter's finally submitted vote will be counted.

In answering the following questions, justify your main decisions by citing paragraph numbers from the above text where apropriate

a) State any 2 functional requirements for the voting booth and 2 more for the Server. [4]

b) Present a Data Flow design in the form of a Data Flow Diagram (DFD) for the software in the voting booth. In addition, write a sentence on the purpose of each process in the DFD. However, a context diagram is not needed. [8]

c) Formulate a design by Functional Decomposition for the software in the Server. Your answer should be presented as a hierarchy diagram of functions. In addition, write a sentence on the purpose of each function. [8]

Question 2

d) Define the 5 main phases of a software engineering project. In addition, state the main activities performed, and documents produced, during each phase. [15]

e) Present the following project planning statement as fully as possible in the form of a Work Breakdown Structure (WBS) diagram:

> "We intend to undertake this project by developing 2 prototypes quickly before developing the final product. The first prototype will be developed using Data Flow Design and Pascal programming. The second prototype will be developed using Object Oriented Design and C++ programming. Finally, lessons learned from development of the prototypes will be applied to develop a new system from scratch." [5]

Question 3

a) Briefly define any 5 items you would expect to see documented in a project plan. [5]

b) Consider the table of activities planned for a project, shown further below. Use the information in the table to formulate the following:

i. PERT chart for the project [6]

ii. Gantt chart for the project [6]

iii. The project's critical path and shortest completion time [3]

Activity	Duration (days)	Prerequisite activities
A	4	-
B	8	-
C	19	-
D	2	-
E	3	C
F	2	A, D
G	1	F
H	3	G
I	11	B
J	4	H, I
K	7	A
L	3	E, K

Question 4

a) List the contents of the "Specific Requirements" section of the IEEE standard for requirements specifications (IEEE 830-1993 section 3). In addition, briefly describe the meaning of each listed item. [10]

b) Suppose that you are developing an application that enables students to obtain examination results via the Internet:

i. Explain in some detail how you would conduct requirements elicitation for this application using either scenario-based analysis or prototyping. [3]

ii. Contradiction and ambiguity are common problems affecting requirements stated in natural language. Write down 2 or more requirements for this application and clearly point out a contradiction and an ambiguity contained therein. [4]

iii. Model the following domain information in the form of an Entity-Relationship (E-R) diagram:

"Each student has a name, ID number and password. Each student may register for 1 or more courses. Each course has a title and code number. Some courses may not have any registered students." [3]

Question 5

a) What is meant by cohesion? Furthermore, state the main characteristic of a design which possesses sequential cohesion. [3]

b) Work out the cyclomatic complexity of the following Pascal procedure: [7]

```
PROCEDURE copyList(given: List; VAR result: List);
VAR
  here, stop, endPos: Position;
  item: ElementType;
BEGIN
  initialize(result);
  here := first(given);
  stop := last(given);
  WHILE NOT equal(here, stop) DO
    BEGIN
      item := retrieve(given, here);
      endPos := last(result);
      insert(result, endPos, item);
      here := next(given, here)
    END
END;
```

c) Using Halstead's method, work out the size of vocabulary and program length of the procedure given in part b) above. [10]

Question 6

a) Distinguish between the following sets of terms:
   i. Verification and validation
   ii. Error, fault and failure
   iii. Black box and white box testing
   iv. Retest-all and selective retest [8]

b) Describe how a code inspection is conducted. [4]

c) List the 4 kinds of maintenance activities. Furthermore, supposing that you are maintaining a word processing application, describe 4 situations that will require you to carry out maintenance (describe one situation for each kind of activity). [8]