University of Liverpool
Department of Computer Science
COMP201: Software Engineering
September 2001 (resit) Exam

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Instructions to Candidates

Attempt *all* questions in Section A.
Attempt *any one* question from Section B.

SECTION A — Answer *both* questions in this section.

Both questions refer to the following case study:

> A University has decided to develop a database system to record staff details. Each member of staff is uniquely identified by a code number, and the database is to be indexed by these code numbers. This database is to record, for each member of staff, the following information:
>
> - staff code/employee number;
> - name;
> - name of department in which person is employed;
> - grade (a value in the range 0 to 10);
> - gross salary per annum (in £/year);
> - tax rate (a real number in the range 0.1 to 0.4).
>
> Note that:
>
> - total tax paid = gross salary * tax rate
> - net salary = gross salary - tax.
>
> The system will allow the operations such as the following:
>
> - add new member of staff;
> - retrieve details of staff member;
> - modify existing staff details;
> - compute annual tax of a specified employee;
> - list all staff in a Department;
> - find out which Department a member of staff is in.
>
> Users of the system fall into two categories: super users and regular users. Regular users are allowed to query their own tax, list staff by department, and find out which Department a member of staff is in — all other operations are restricted to super users.

Question 1

a) Write a Z schema called *StaffDB* for the state space of the system. Ensure that you explain any types that you parachute in, and any assumptions that you make.

(10 marks)

b) Write a Z operation schema *ChangeStaffDetails*, which will take as input an employee number and a new collection of staff details, and will modify the details of this employee accordingly.

(10 marks)

c) The amount of income tax a member of staff is required to pay per annum is computed as the gross salary times the tax rate. Write a Z operation schema called *ComputeSalary* that will take as its one input a staff code number, representing the code number of a member of staff, and will generate as its one output a variable representing the net salary of the member of staff identified by.

(10 marks)

c) Write a Z operation schema *LowTax* that will generate as output a set containing the staff codes of all employees who pay less than £500 tax per year in total.

(10 marks)

Question 2

With reference to the University employee information system described above, using the Unified Modelling Language (UML):

a) Give use case diagrams for the system.

(10 marks)

b) Derive a conceptual model for the system.

(20 marks)

c) Develop a collaboration diagram for the "add new member of staff" operation.

(10 marks)

SECTION B — Answer *any one* question in this section.

Question 3

a) Explain what you understand by *black box testing* and *white box testing*, making the distinctions between them clear. (4 marks)

b) With the aid of examples, explain the roles of

i) *equivalence partitions*

(4 marks)

ii) *boundary analysis*

(4 marks)

iii) *code inspections*

(4 marks)

iv) *alpha and beta testing*

(4 marks)

in software testing.

Question 4

a) Explain the key steps in the *waterfall model of the software lifecycle*.

(5 marks)

b) With reference to its intended audience, explain what you understand by the term "requirements definition document".

(5 marks)

c) With the aid of short examples to illustrate its content, outline the IEEE standard structure for requirements specification documents.

(10 marks)