THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
Professional Graduate Diploma

SOFTWARE ENGINEERING

24th April 2006, 2.30 p.m.-5.30 p.m.
Answer THREE questions out of FIVE. All questions carry equal marks.
Time: THREE hours.

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. *a)* Briefly describe TWO testing strategies for a software module that takes as input, and acts on, a set of six elements of data. The internal workings of the module are not available for testing. A detailed specification of the module's functionality is available, and this declares that all input data are validated. The ranges of each element of data are known. Some data elements, in a group, act together to describe a functional scenario. **(12 marks)**

b) Design a test strategy for a function with the following definition:

The function will process a scientific computation. Input data will be a set of parameters between 4 and 10 numbers, where each number will have 5 digits and be greater than 10,000. Input data validation will ensure the inputs are correct before computation begins. **(13 marks)**

2. *a)* "Software tools have moved the development of software from a profession of craft to a profession of product engineering."

Discuss this statement, giving TWO arguments in favour and TWO arguments against, and make an overall conclusion based on the arguments you provide. **(12 marks)**

b) Describe THREE functions, characteristics or functionalities of a software tool that supports source code control, and includes the sharing of code development among several programmers. **(13 marks)**

3. *a)* What THREE aspects of risk can be identified during software product development? **(12 marks)**

b) The formula for risk exposure is the sum of the products of each impact multiplied by its probability, for each risk. Calculate the risk exposure for the following data about a software development project. Give full reasons for each step of your calculation.

- If the project is late, it will cost £10,000 per week. Recently, 7 out of our last 10 projects were late, with an average delay of 4 weeks.

- If the integration phase is smooth, it will save time. Integration is currently planned to take two weeks, at £5,000 per week. Previously, 5 out of our last 10 projects took longer than planned, the worst being 6 weeks longer because of the amount of redesign and rebuild we had to do.

- If the client has stable finances, we will get paid on time. From our records, 3 out of our last 10 clients delayed payment for an average of 6 weeks because they had financial difficulties. Each month we run an overdraft on this kind of project and non-payment costs us £1000 per month in charges. **(13 marks)**

4. Software development, as a relatively new engineering discipline, is beginning to exhibit underlying principles that might be considered to be both enduring and universal.

Present a brief discussion of each of the following principles. You should make clear any distinctions between the terms used, and evaluate the universality of the principle itself.

i) Minimise coupling between, and maximise cohesion of, components; **(6 marks)**
ii) Use formal methods to both define software artefacts rigorously and manage quality throughout the development life cycle; **(8 marks)**
iii) Build systems for reuse and with reusable components; **(6 marks)**
iv) Control system complexity and implement disciplined and flexible process cycles. **(5 marks)**

5. A telephone company supplies its domestic customers with communications equipment and services. Subscription customers are charged a monthly fee of £40 for two years. These customers receive the equipment for the service at no extra charge and have no limits imposed on the amount of the service consumed. Other customers are charged for the equipment and billed £2 per unit of service consumed during peak periods (9am to 6pm), and £1 per unit at other times.

A Customer Billing System is required. From the system description given, answer the following questions.

a) Produce a list that gives the names of each possible entity, their attributes and any required processes; **(8 marks)**

b) Use an appropriate modelling technique (state any assumptions made) with supporting notation to demonstrate:

i) the behavioural aspects of the system; **(7 marks)**
ii) the structure and relationships within the system **(6 marks)**

c) Briefly discuss how any future changes to the fee and billing structure might impact on the current design and implementation model. **(4 marks)**