

# THE BRITISH COMPUTER SOCIETY

## THE BCS PROFESSIONAL EXAMINATION Professional Graduate Diploma

### SOFTWARE ENGINEERING

9<sup>th</sup> May 2003, 10.00 a.m.-1.00 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) Your software manager has asked for your advice. The cost of your own in-house development averages £360 per day. Your manager is considering the purchase of a software package that is 5KLOC (five thousand lines of code) that will cost £50,000. Initial evaluation of the package indicates it will need a tailored interface to suit your company; this will involve extra code that is 1KLOC (one thousand lines of code). A complicating factor is that the supplier has offered to do the extra work for a total cost including the initial package of £65,000.

Use the parametric equations as shown in **Figure 1** below to estimate the software development cost of three alternative courses of action.

- buying the total package;
- buying the basic package for £50,000 and developing the new functionality in-house, where the in-house development style will need to be SEMI-DETACHED;
- developing the whole functionality in-house without reference to any external supplier. In this case, the development style will be ORGANIC.

(20 marks)

- b) Give ONE or TWO risks that could be assigned to each course of action. In your view, does this risk appraisal significantly alter the estimates of cost? Include your reasons.

(5 marks)

#### Basic Parametric Model for Estimation of Effort and Duration

This basic estimator is a management model that computes effort and duration of a software development as a function of program size estimated in thousands of lines of code (KLOC). Duration is converted to cost using agreed conversion measures.

Effort = a (KLOC)<sup>b</sup> in units of person-months,  
and Duration = c (Effort)<sup>d</sup> in terms of elapsed months.

Parameters a, b, c and d are given in the table below:

The Project	a	b	c	d
ORGANIC	2.4	1.05	2.5	0.38
SEMI-DETACHED	3.0	1.12	2.5	0.35
EMBEDDED	3.6	1.20	2.5	0.32

*IF you do not have access to a calculator, use the "Tables of Exponent Values for Basic Estimator Calculations" in the Appendix at the end of this question paper. For fractions, interpolate between whole numbers.*

#### Common values for estimating time:

number of working days in a year (excl. holidays, sickness, etc.) = 220

number of working days in a month (excl. weekends, holidays etc.) = 20

**Figure 1**

**Turn over]**

2. a) Describe the differences between Quality Assurance (QA) and Quality Control (QC) with reference to a software development project. **(6 marks)**
- b) Some writers about software development methods claim that "Quality is free". Do you agree with this? Give your reasons. **(12 marks)**
- c) How would you measure the effectiveness of QA and QC on a software development project? Give reasons for your answers. **(7 marks)**

3. The management team of a local college has given you a 12-month contract to develop software for a very powerful computer workstation donated by a local electronics company. A wide range of system software is available including operating systems, compilers, and program debuggers. The company has also supplied an integrated CASE tool, but no application software. In appointing you, the College Principal is particularly interested in developing a Student Records System that is portable, reusable, and scaleable, but tailored to the teaching and learning environment of the college.

Identify and discuss the software engineering design and implementation principles that, when applied, produce application software that is fit for the purpose of the college. **(25 marks)**

4. A specialist bookshop, wishing to enter the online services market, would like to develop an online ordering system within the next six months.
- a) Identify and compare TWO viable but distinct process models that might be used for this particular project. **(10 marks)**
- b) Select ONE of the process models identified in part a) and provide a complete description of its application in the development of the bookshop project. **(15 marks)**
5. Consider the case of a small company wishing to develop an in-house payroll system for its 100 regular contracted staff who are all paid on a daily basis. The fundamental elements of the application software will involve both data structures and algorithms. However, the application can only be designed using a data-driven or process-oriented approach.

Evaluate the merit of each approach to design, and illustrate your answer with examples of how each approach would be applied to produce a design solution for the payroll system. **(25 marks)**

**Appendix** (for use in Question 1)

**Tables of Exponent Values for Basic Estimator Calculations**

KLOC raised to the power b, to 2 decimal places:

KLOC	b=1.05	b=1.12	b=1.20
4	4.29	4.72	5.28
5	5.42	6.07	6.90
6	6.56	7.44	8.59

Effort raised to the power d, to 2 decimal places:

Effort in person-months	d=0.38	d=0.35	d=0.32
1	1.00	1.00	1.00
2	1.30	1.27	1.25
3	1.52	1.47	1.42
4	1.69	1.62	1.56
5	1.84	1.76	1.67
6	1.98	1.87	1.77
7	2.09	1.98	1.86
8	2.20	2.07	1.95
9	2.30	2.16	2.02
10	2.40	2.24	2.09
11	2.49	2.32	2.15
12	2.57	2.39	2.21
13	2.65	2.45	2.27
14	2.73	2.52	2.33
15	2.80	2.58	2.38