

**THE BCS PROFESSIONAL EXAMINATION
Diploma**

April 2003

EXAMINERS' REPORT

Project Management

General

The number of candidates selecting this module continues to rise each year and this year saw an increase of over 33%. Unfortunately there were a significant number of candidates who had not studied the syllabus and thus failed to obtain a pass mark in more than one question. Others simply did not appear to have read the question. As an example see the examiners comments regarding the diagrams produced in 'answer' to question 1a). Many ignored the scenario given in a question. Candidates should note that the scenario given in a question is always important and knowledge given in the answer should be related to the scenario and not just a simple dump of knowledge in the general area of the question.

Not surprising therefore the overall pass rate dropped from 65% obtained last year to 58% this year and the mean to 39%.

An indication is given below of the points expected; however any valid point, which was relevant to the question, received marks.

Question 1

Two organizations have merged to form ABCplus, which is a large financial services provider. The management of ABCplus have decided to replace the in-house purpose-built payroll applications in the pre-merger organizations by a single off-the-shelf (OTS) package. ABCplus has selected and acquired a suitable package.

- a) Draw a work breakdown structure (WBS) for the activities that would be needed in order to make the package operational at ABCplus. (15 marks)**
- b) Describe the various methods of 'going live', and the extent to which each of the methods would be suitable for the ABCplus payroll implementation.**

(10 marks)

Answer Pointers

The question scenario was important here. Two organisations had merged and decided to replace their existing (separate) payroll systems with a single off-the-shelf package - which had already been selected.

In part (a) candidates were asked to draw a WBS for the activities needed to make this payroll package operational.

A significant proportion of the diagrams produced by candidates included most or all of the selection process (which as the question stated had already been completed and was therefore not relevant) and others set out the work required to develop (i.e. design and code) a new in-house system, rather than to implement a package.

The answer was expected to demonstrate the principles of drawing a WBS, with a top-down breakdown of clearly identifiable tasks under a number of main headings.

Marks were awarded initially for the identification of sensible number of main

headings relating to payroll, system replacement and to the use of a package - and then for the successive breakdown of major tasks within each heading. For instance, five main headings and task breakdowns could have been:

- **installation** - which might include:
 - establish central payroll office
 - select hardware
 - Install hardware
 - install software
 - find out system parameters
 - set system parameters
 - **staffing** - which might include
 - identify staffing and training needs
 - select staff
 - transfer/let go redundant payroll staff
 - design/plan training
 - train staff
 - **acceptance** - which might include
 - plan testing
 - produce test cases
 - run tests
 - check results
 - **populate database** - which might include
 - obtain personnel details
 - set up details
 - check details
 - **other activities** - which might include
 - draft office procedures
 - acquire special stationery etc
 - make arrangements with BACS, Contributions Agency etc

In this instance 5 marks for the headings and up to 3 marks for the breakdown within each heading. **Total 15 marks**

Part (b) for descriptions of the various types of "going live", and the extent to which each of these would be suitable for implementing a new single package in the newly-merged company. The various methods were very well known and understood, but many candidates provide too generalised a discussion of the relative merits of each approach rather than relating each to the specific situation.

Out of the **total of 10**, one mark was given for each of the three main methods (treating "pilot" as a variant of "phased" or "staged" in the payroll context) and further 2 or 3 marks for the discussion of each approach:

- *sudden death*: factors in favour include one month gap between main payroll runs, allowing time to prepare; no need to keep old and new offices running in parallel for a substantial period of time.

3 marks
- *staged*: variations on this theme: by groups of functionality; by location of users; by groups of data (e.g. different groups of employees). Spreads the workload, including support. Might need to keep redundant offices open longer. Payroll tends to be rather monolithic. OTS rather than in-house development that can be delivered in chunks.

4 marks
- *parallel running* of old and new applications: need to run old and new offices in parallel; very expensive; but there is an instant fall-back if new system fails.

Generally batch nature of payroll makes this seem over the top. Retrospective parallel running where data that has been input into old systems over last three months is put through new system seems more appropriate. 3 marks.

The specific nature and requirements of a new (albeit package) payroll system, and the need for results to be right "first time" to avoid staff discontent, etc were rarely mentioned. Many answers referred to financial or accounting (and even "mission-critical") systems in this part of the answer - presumably as the merger had created a "financial services provider".

Of the 52% of candidates who attempted this question 41% achieved a pass standard. The average mark was 8.

Question 2

A software development project will have the following activities. The estimated elapsed time for each of the activities is given.

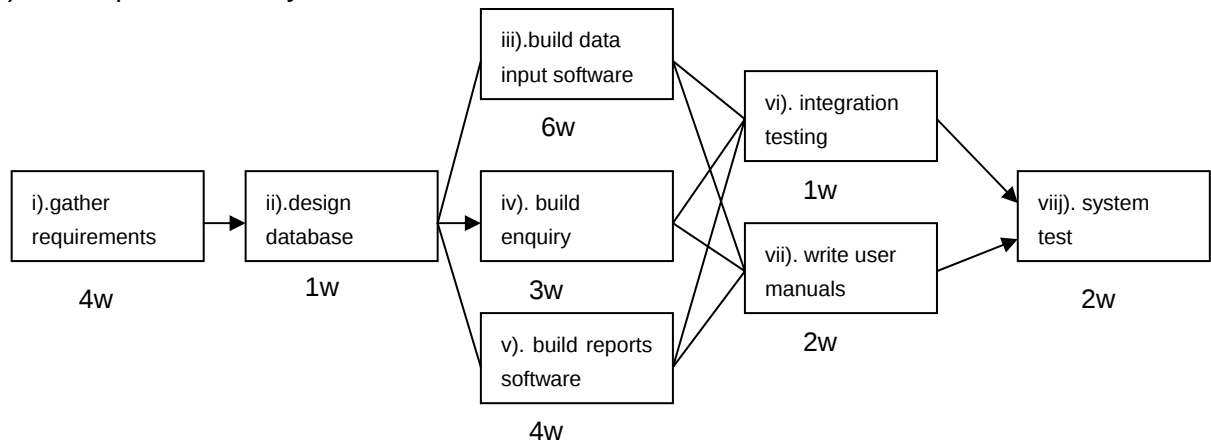
- (i) detailed requirements gathering and specification (4 weeks).**
 - (ii) database design (1 week) - this will be based on the data analysis carried out in activity (i).**
 - (iii) build data input software (6 weeks).**
 - (iv) build enquiry software (3 weeks).**
 - (v) build reports software (4 weeks).**
- Tasks (iii), (iv), and (v) can be carried out at the same time.**
- (vi) integration testing (1 week) - this is carried out by the developers to ensure that the three software components operate together correctly.**
 - (vii) writing user manuals (2 weeks) - This activity is started as soon as the building of the three components of software have been completed, but does not have to wait for integration testing.**
 - (viii) system testing (2 weeks) - this is done by the end-users, who follow the instructions in the user manuals to try out the integrated system.**

Using the above scenario,

- a) Draw up an activity network (7 marks)**
- b) Calculate the earliest start, latest finish (expressed in week numbers) and float, for each of the activities in the scenario, explaining each step in the calculation. Show how the floats for activities can be used to indicate the critical path for the project. (12 marks).**
- c) Discuss the limitations of using activity networks as a planning tool. (6 marks)**

Answer Pointers

(a) The expected activity network was as follows:



Up to 2 marks were awarded for the correct notation and up to 5 for the correct order. Many candidates used the activity on arrow rather than the activity on node notation shown above. That was perfectly satisfactory. Sometimes the sequencing suggested by candidates cast doubts on their general knowledge of the software development lifecycle. Some candidates combined the answer to (a) and (b) by putting earliest start dates etc. on the diagram. This was accepted and marks awarded to those candidates who provided a key showing to what the figures referred.

(b) The expected answer for the earliest start, latest finish and float is shown below.

activity	ES	duration	EF	LF	LS	float
i	0	4	4	4	0	0
ii	4	1	5	5	4	0
iii	5	6	11	11	5	0
iv	5	3	8	11	8	3
v	5	4	9	11	7	2
vi	11	1	12	13	12	1
vii	11	2	13	13	11	0
viii	13	2	15	15	13	0

Half of the marks were awarded for an explanation and half for the calculations of the following:

earliest starts	4 marks
latest finishes	4 marks
floats	2 marks

Identifying critical path by zero floats
2 marks

Some candidates confused activities and events. Where earliest and latest *event* times and slacks were presented rather than the earliest start and latest finish times of *activities*, this was, however, marked sympathetically. A very common mistake was to omit the explanation of how the calculations were done.

c) Limitations that might have been discussed included:

- not taking account of iterative approaches
- not taking account of conditional activities (e.g. X will need to be done under circumstances Y)
- overlapping activities can be difficult to model
- continuous assembly line type operations (e.g. transferring and then checking documents) can be difficult to model properly
- ongoing background or support tasks such as managing/supervising not easy to model satisfactorily
- not taking account of resource constraints

1 or 2 marks were awarded for each valid point up to a maximum of 6 marks. Most candidates mentioned the limitation in dealing with resource constraints, but in general this part of the question attracted quite poor answers.

Of the 88% of candidates who attempted this question 83% achieved a pass standard. The average mark was a respectable 14.

Question 3

A project manager is put in charge of a project which will involve the design, building, testing and installation of a billing application. A detailed requirements specification and an outline plan of activities together with resource requirements have been produced.

- a) **Explain the process by which the project manager would assign resources (mainly staff) to the activities of the project.**
(12 marks)
- b) **Identify the modifications which may be required to the original plan as a result of the resource allocation process.**
(4 marks)
- c) **Identify other factors, not already mentioned above, which a project manager might need to take into account when allocating staff to project activities and roles.**
(9 marks)

Answer Pointers

In this question the scenario was again important. The project is the complete development of a new billing system. The requirements specification and outline plan of activities (with resource requirements) have all already been produced.

Part (a) asked for an explanation of the process by which the project manager would then allocate resources to the activities of the project. The main steps here were expected to be:

- identify resource groups (i.e. groups of specialists individual member of which are interchangeable when it come so allocating a specialist to a task)
- allocate resource groups to activities, assuming that each activity starts as soon as possible
- check for resource clashes where not enough specialists are available at one time to do a task
- resolve resource clashes e.g.
 - use any float to move start dates
 - reallocate staff from activities with float to one with clashes
 - delay start of later activities (and the overall project completion date)

- increase staffing pool by acquiring more resources
- examine %utilization of staff

For this, marks were awarded:

general steps to be taken	6 marks
steps to resolve resource clashes	4 marks
consideration of % utilization	2 marks

Total 12 marks.

A very significant number of candidates omitted the key initial steps for allocation, and started instead with resource histograms (which pre-suppose that the allocation has taken place) and/or Gantt charts. Very few answers included either resource clash resolution (even though resource histograms were mentioned) or the consideration of staff utilisation.

In part (b), the modifications that might need to be made here (still at the initial stage of the project - **not** during the project) include:

- some activities might be split into smaller ones to allow staffing flexibility
- some activities might be delayed because of resource clashes
- an inexperienced, less productive, member of staff being allocated to an activity might cause the activity duration to be extended (or vice versa) **4 marks**

For part (c) there is a wide range of possible other considerations, including:

- staff experience
- staff skills (including interpersonal ones)
- cost of individual staff
- staff compatibility
- other personal commitments (e.g. holidays, training etc)
- personal commitments to work on other projects (e.g. maintenance and support)
- need to juggle resources between parallel projects
- sensitivity of tasks on the critical or sub-critical paths
- risks associated with individual tasks
- general project activities not associated with specific planned tasks e.g. management, supervision, quality reviews etc
- staff utilisation (what will staff be doing between tasks?)
- motivation of staff (might be affected if staff are having to chop and change between different tasks)

This part was usually answered well. Often, many of these points had been made in part (a) and the marking scheme was adjusted to give full credit for these.

9 marks

Of the 65% of candidates who attempted this question 33% achieved a pass standard. The average mark was 8.

Question 4

- a) Explain how COCOMO and Function Point Analysis (FPA) can be used to produce estimates of development effort, comparing and contrasting the two approaches.**

(16 marks)

- b) A new company has been created and have recently set up their own Information & Communications Technology (ICT) department. Staff in the ICT department are required to provide an estimate of the development effort required for a series of new projects. As this**

is a new department there are no past projects which staff could use to guide their estimation.

Explain and justify one or more methods they might use to estimate development effort. (9 marks)

Answer Pointers

(a)

COCOMO

(**note** the syllabus refers specifically to COCOMO 2. The marking scheme tried to treat COCOMO 81 and COCOMO 2 as variations of the same underlying general model. Candidates who showed a specific knowledge of COCOMO 2 received extra credit.)

Valid points might have included

- *primarily* designed for heavy software engineering projects rather than information systems
- primary task size driver is lines of code (later model makes provision for FPs to be converted to 'equivalent lines of code')
- exponent is used to take account of diseconomies of scale for larger projects
- effort multipliers (related to factors such as analyst experience of the domain) vary the productivity rate that is applied
- result is a estimated effort figure
- productivity based on concept of industry average

8 marks

A complete description of COCOMO including all the formulae, especially if COCOMO II were covered in depth, would have been very extensive and was not expected. What we were looking for was evidence of an understanding of the general approach. Sometimes candidates could regurgitate formulae, yet clearly did not grasp the actual purpose of COCOMO. There was a large batch of candidates from one centre who all talked about 'effort crude' (sic) and 'effort improved' and also referred to 'weightages'.

FPA

Valid points might have included:

- primarily designed for information systems
- two main versions IFPUG (or Albrecht) and Mark II (or Symons).
- primary size drivers are counts of externally apparent features of software (e.g. numbers of input, output and enquiries, internal and external datastores for IFPUG)
- different weighting for different types of feature
- TCA used to take account of other, non-functional, requirements
- result is the equivalent of a size indicator which can be used to derive productivity rate from historical project data (e.g. FPs per day) and to estimate effort for new projects where FPs are known (FPs/FPs per day).

8 marks

The Function Point approach was generally very poorly addressed, even where candidates had displayed some familiarity with COCOMO.

(b) The typical elements of a good answer to part (b) are outlined below:

FPs or other methods that require historical productivity rates would not be useful initially in the scenario outlined.

COCOMO effort drivers might be difficult to calibrate accurately if staff experience etc was not well known.

2 marks

A bottom-up approach could be adopted where projects are broken down into component activities, and sub-component activities until tasks of about a one or two weeks staff effort are identified. These are then aggregated. 4 marks

Delphi and expert judgement might also be appropriate methods and candidate might explain these 3 marks

'Price to win' and 'Parkinson' were suggested by some candidates. These approaches were identified by Boehm in his taxonomy of estimating methods, but were also condemned by him. 'Outsourcing' was also suggested by some candidates: this might be applicable to the scenario that had been outlined, but was clearly not an *estimating method*.

Of the 46% of candidates who attempted this question 46% achieved a pass standard. The average mark was 8.

Question 5

A commercial company has a customer services department, the members of which will be users of a new software application which is to be developed. The company's Information & Communications Technology (ICT) department is small and mainly carries out the maintenance of existing applications. The ICT department does not have the staff or the experience to develop new applications. It therefore employs an external ICT consultancy to design and build the application. The consultancy in turn employs contractors to do some software coding tasks.

- a) Identify up to FIVE main stakeholders in this scenario and describe their probable concerns and motivation in relation to this project; (10 marks)**
- b) Describe the organizational structure needed to control and manage this project. (6 marks)**
- c) Identify THREE key reports that would need to be produced to monitor and control the project, who would produce them, for whom they would be produced and the nature of their content. (9 marks)**

Answer Pointers

The question set out a clear system development scenario involving a number of different organizations, each with clearly identified responsibilities and involvement in the project.

Part (a) asked for up to five stakeholders to be identified, with a description of their probable concerns and motivation.

The main *stakeholders* and their concerns might be:

<i>stakeholder</i>	<i>concerns</i>
user management	business case, staff costs, development costs
users	ease of learning, fitness to task, job security
ICT department	ensuring consultants fulfil contract, effect of possible outsourcing, maintenance and support
consultants	satisfaction of contractual obligations within budget, possibility of new work
contractors	satisfaction of contractual obligations, possibility of new work, enhancing CV by learning new skills etc

For this: 1 mark for each valid stakeholder and 1 mark for valid concerns etc, up to
10 marks

The concept of a stakeholder (ie one "affected by" or "with a clear effect on" the project) seemed very unclear in many answers, which tended to concentrate on each group's day-to-day involvement and responsibilities within the project. There was also considerable lack of clarity of the work that each group was expected to undertake within the project. The question did not mention "customers" nor did it imply that customers might be affected, either directly or indirectly, by the new system yet many answers included this group as a main stakeholder (usually omitting the user management who are funding and, probably, sponsoring the project).

Part (b) asked for an organizational structure to **control and monitor** the project. Again the wording was important and implied "project" organization structure (rather than team type or the standard organization structure), ie:

- probably need a *project board* or *steering committee* with representatives of users, company management, ICT department and main contractor to set objectives, allocate resources etc.
- a *project manager* within customer organization to manage the day to day running of the project and to manage the contract with the main contractor
- a project or account manager within the contractor organization, plus team leaders etc
- user representatives to organize any tasks that need to be done with user area, e.g. training, data take-on, user acceptance
- possibly a quality assurance team and project office

6 marks

In **Part (c)** candidates were asked to identify three key (different) reports needed to monitor and control the project, with likely authors, recipients and contents.

These might include the following

<i>Report</i>	<i>from whom</i>	<i>to whom</i>	<i>content</i>
checkpoint report	team-leaders	project manager	details of individual progress on activities
highlight report	project manager	project board	summary of progress and outlook for future
exception report	project manager	project board	notification that problem has arisen requiring major change to agreed plans

Up to 3 marks were allowed for each valid report (different terminology was acceptable provided the nature of the report is clear) **9 marks**

Most candidates identified the type of reports required, though very few provided **all** the requested information for each report. However, several answers named specifications, system or program documentation, user manuals, post-project review, etc - none of which are key to "monitor and control"

Of the 59% of candidates who attempted this question 42% achieved a pass standard. The average mark was 9.

Question 6

- a) **'A project must be managed so that the underlying business case is preserved'. Explain the meaning of this statement.** (6 marks)
- b) **Describe the steps a project manager should take, and the recommendations which might be made, if a project has fallen behind schedule.** (7 marks)
- c) **Explain how you would ensure the completed products of a project were of sufficient quality.** (12 marks)

Answer Pointers

(a) Business case

The expected answer was along the lines that, in general terms, the business case for the project is maintained as long as the development and operational costs of the application to be delivered do not exceed the value of the benefits of the project. Increased costs, reduced functionality, and deferred delivery could all have an impact on this business case.

6 marks

Many candidates seemed to simply reiterate the question as an answer.

(b) Steps to be taken if project is falling behind schedule might have included:

- to manage to recover by applying project contingency funds
- reschedule resources from activities that might be ahead to those that are behind
- issue an exception report, recommending either:
 - delaying the delivery date
 - drafting in more resources

- reducing the amount of functionality to be delivered
- reducing quality
- abandoning the project if the business case is clearly no longer sustainable

7 marks

Generally, this was quite well answered. There was, however, a tendency with some candidates to see the falling behind schedule as essentially a productivity problem, and to lose sight of the wider implications.

(c) The marking criteria that were used are outlined below:

quality criteria

A key measure is to define at the outset the required quality of each major product and the way that this quality is to be tested.

2 marks

testing

There are different types of testing that could be discussed e.g. functional testing to see software is correct, usability testing, volume testing to check performance and reliability.

up to 5 marks for discussion in this area

reviews and inspections

up to 5 marks for discussion in this area

Other valid points might be made concerning other activities that might be undertaken and due recognition can be given in these cases.

The answers to 6(c) varied considerably in quality. One common failing was to discuss project control in general terms, e.g. cost and task monitoring. Some candidates identified Post Implementation Reviews (PIRs) as quality control processes: PIRs generally occur after a project has been completed and so would be too late to have an influence on the products of the project. There often seemed to be a misunderstanding of ISO 9001: the suggestion seemed to be that the standard lays down software quality criteria, rather than describing the generic characteristics of a Quality Management System. A few candidates described quality control procedures that were more suited to an industrial production environment than to software development.

Of the 86% of candidates who attempted this question 47% achieved a pass standard. The average mark was 10.