THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 5 Diploma in IT

October 2007

EXAMINERS' REPORT

IT PROJECT MANAGEMENT

The trend for October candidates to be better prepared than those candidates for the April examinations continues. Examiners were pleased to note a significant increase in the passing rate compared to April. There were many first class answers and one candidate produced a near perfect paper and obtained a well deserved mark of 90%.
However there remain some very poorly prepared candidates and around 19% obtained a mark of 25% or less.
Candidates were able to provide a good answer, and to pass, one question but had very limited knowledge of the other topics covered on the paper. Such candidates need to ensure they understand more of the topics contained within the syllabus

Many candidates from one centre provided answers to three questions and not the four required. Some of whom only required a few more marks to have reached an overall pass for the paper.

An indication of the points expected by the examiners is given below, together with comments which it is hoped will assist candidates in future examinations. Any point which was valid and relevant to the question received marks. However candidates are again reminded that to obtain good marks they should ensure they answer all parts of the question as set, and to carefully consider and apply their answers to any scenario which is given.

Question 1

You are assigned the role of project manager for the design phase of a project which is to produce a specially written financial application for a large commercial organization. A preliminary requirements document has been produced.

a) Outline the steps needed, given a requirements specification, to produce a satisfactory design for the application. **(10 marks)**

b) Explain your role as the project manager for the design phase with particular reference to the types of communication that you would have with the design team. **(9 marks)**

c) Identify the types of communication, both direct and indirect, that there would be between the client organization and the design team. **(6 marks)**

Answer Pointers

a) These steps would vary depending on the methodology used but would be likely to have the following main groups of steps:
- Planning the design process, e.g. selecting appropriate staff
- Reviewing and clarifying recorded requirements to ensure they form an adequate basis for design
- Analysis to produce a physical model of the current systems – could use notations like entity relationship diagrams (ERD) or data flow diagrams
- Conversion of the physical current model into a logical or conceptual model by removing physical constraints e.g. on access to common data stores
- Adding new requirements not in the original system
- Conversion of the logical model into a new physical model which can be implemented on the target platforms. There will two types of design here:
  - External design e.g. of interfaces
  - Internal design e.g. of the hardware configuration and software architecture
- Prototypes might be used to help elicit more precise user requirements or to explore interface or physical design options

1 or 2 marks (depending on the detail provided) for each substantive step identified, up to a maximum of 10 marks.

b) Project management roles might include:
- Planning, allocation of work packages to project team members;
- Collection of progress information
  - Meetings – perhaps weekly checkpoint meetings or even daily stand-ups
  - Collection and review of timesheet information
- Taking remedial actions after consultation with stakeholders such as developers, users and managers
- Reporting upwards, summarising progress information
- Liaising with clients, users etc

1 or 2 marks (depending on detail) for each role identified, up to a maximum of 9 marks.

c) User communications
- Direct communications e.g.
  - Requests to users for additional information to assist design;
  - Use of users to evaluate design decisions e.g. to try out early prototypes of interfaces
  - Interface designs may need to be signed off by client/user
- Indirect communications e.g.
  - Copies of progress reports to client/user representatives via the steering committee or project board

- o Change requests where requirements might have been altered – these changes should have been approved by the equivalent of a change control board
- o Discussion of progress at steering committee meetings etc

(up to 6 marks for valid points)

Examiners' Comments

a) This part tended to be poorly answered. Some candidates, for example, provided a list of **all** the steps in the software development lifecycle without explaining, as required, what tasks were done in the design phase. This lack of knowledge about the types of task carried out in each step of the system lifecycle has been noted before in previous examiners reports.
b) Some candidates did not distinguish carefully between the responsibilities belonging to the role project manager as opposed to those of a lead system designer or architect role. These are clearly different, although on a small project the same person might combine both roles. There was also a tendency for candidates to focus on the general project manager role and ignore the specifically communication aspects, or vice-versa.
c) Some candidates simply listed a number of communication modes e.g. meetings, email etc. Some credit was allowed for this, but as the question specifically mentioned communications between the client organisation and the design team, candidates should have realised that more attention to these particular communications was needed.

Question 2

a) Explain what is meant by an algorithmic or parametric modelling approach to software effort estimation. **(4 marks)**

b) Describe in outline TWO specific algorithmic models for estimating effort. **(12 marks)**

c) Discuss the suitability of the two models for estimating project effort identified in (b) above for the scenario as described in Question 1. **(4 marks)**

d) Evaluate the following statement. "In practice, the use of expert opinion to produce estimates of development effort is effectively the use of analogy." **(5 marks)**

Answer Pointers

a) With algorithmic models the estimate of effort is created:
- by applying some mathematical model (hence 'algorithmic')
- which takes input values (hence 'parametric') relating the size and nature of the task to be done
- or factors relating to productivity
- The algorithm is often based on an analysis of past projects.

b) Examiners expected Function points and COCOMO to be given as examples as these are mentioned in the syllabus.

Function points:
- An attempt to measure the 'size' of an IS application;
- Based on counts of (allegedly) externally-apparent features of the application to be built e.g. inputs, outputs, and tables accessed;
- The feature counts are weighted to reflect the relative amount of effort required to implement them;
- Creates an index value reflecting the processing complexity of the system;
- Index values can be used to calculate productivity of completed projects (e.g. FPs per day)
- Productivity rate can then be applied to an FP count for a new project to obtain an estimate of effort

(6 marks)

COCOMO

- Based on lines of code as a size measure
- Exponentiation is applied to reflect the finding that larger projects tend to have lower productivity than small ones
- 3 types of project identified with different productivities: organic, semi-detached and embedded
- Development effort multipliers are used to adjust the basic estimate to take account of various productivity factors e.g. programmer experience, analyst experience, reliability requirement etc.

(6 marks)

c) Example of factors to be considered:

- FPs are more suitable for information systems.
- With FPs , a specification of the functionality of the system would be needed which may not be completely defined at this point, so estimate of effort would be speculative. Could be re-assessed at the end of the design phase.
- COCOMO based on lines of code which would be an estimate at this stage.
- On balance FPs are probably more suitable.

d) Expert opinion – asking knowledgeable and experienced people; they could use any method but it is likely their experience would be consulted i.e. past cases that they are familiar with.

Analogy – clearly could be used either informally or formally by an expert; could be used by a non-expert by looking at data collected from past projects and using statistical approach to identify factors that influence effort. Past projects similar to the current one on the dimensions identified as significant could then be extracted. An adjustment can be made to the actual effort recorded for the previous project in order to take account of differences between it and the new project and create the new estimate.

2 marks for correctly explaining the two approaches
3 marks for further valid discussion.

Examiners' Comments

a) Most answers for this section gave satisfactory explanations.

b) Most candidates, as expected, chose the obvious examples of COCOMO and Function Points (FPs). A few, incorrectly, talked about bottom up and top down approaches to estimating which is a different way of categorising estimating methods.
A common failing was to explain the method of calculating FPs at some length but then not explain how the calculated FP would be of use.

c) Generally candidates provided adequate discussion, however some candidates did make assertions, often of a subjective nature - e.g. that COCOMO was easier to use – without a supporting explanation which could not attract marks.

d) Most candidates gave satisfactory answers to this part of question 2.

Question 3

A small research organisation is planning to move to new premises outside the city. The outline plan for this move includes the following main tasks:

A Inspect new premises, list all required communications facilities; (3 weeks)

B Order and deliver all communications facilities and devices; (10 weeks)

C Identify, order and deliver replacement PCs, printers, servers and other hardware; (8 weeks)

D Order and deliver all required office equipment; (11 weeks)

E Test new hardware with all communications equipment; (1 week)

F Test new hardware with all existing operating and applications software; (2 weeks)

G Test all applications software and databases on new hardware; (2 weeks)

H Move all staff to new premises; (1 week)

Tasks B, C and D can all run simultaneously but are all dependent on task A.
Task E is dependent on tasks B and C
Task F is dependent only on task C
Task G is dependent on tasks E and F.
Task H cannot start until tasks D and G are completed.

a) Draw a full Activity-on-Node diagram for this project, showing clearly the earliest and latest start and end dates, and the float, for each node. No start or end nodes are required. Highlight and name the critical path, together with the minimum duration for the project. **(9 marks)**

b) The office equipment (task D) takes two weeks longer than planned to be delivered and installed. Identify and explain briefly the resultant changes to the Activity-on-Node diagram and Critical Path. **(3 marks)**

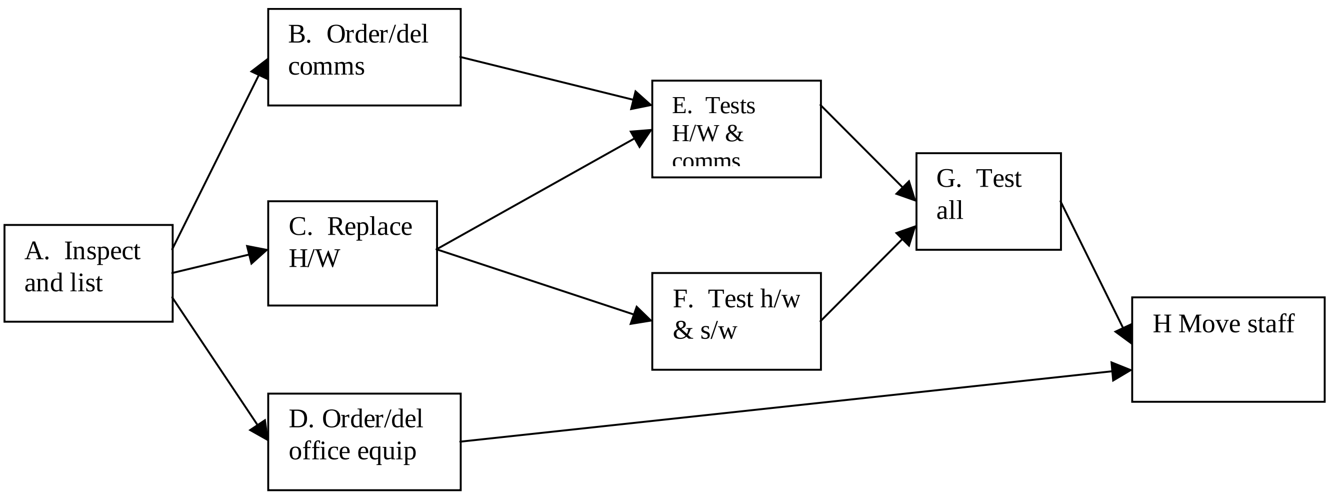
c) Draw a Gantt chart for the revised project, incorporating the change to task D as in part (b). Show all task durations, dependencies, float and the critical path. **(7 marks)**

d) Identify and explain TWO advantages of using a Gantt chart in comparison with an Activity-on-Node network diagram, and TWO advantages of using a network diagram when compared with a Gantt chart. **(6 marks)**

Answer Pointers

a)

The Activity-on-Node diagram should be similar to:



With the following values:

Task	Duration	EST	LST	EFT	LFT	Float
A	3	0	0	3	3	0
B	10	3	3	13	13	0
C	8	3	4	11	12	1
D	11	3	5	13	16	2
E	1	13	13	14	14	1
F	2	11	12	13	14	1
G	2	14	14	16	16	0
H	1	16	16	17	17	0

Preferably with the values incorporated in documented compartments within each Node box in the diagram.

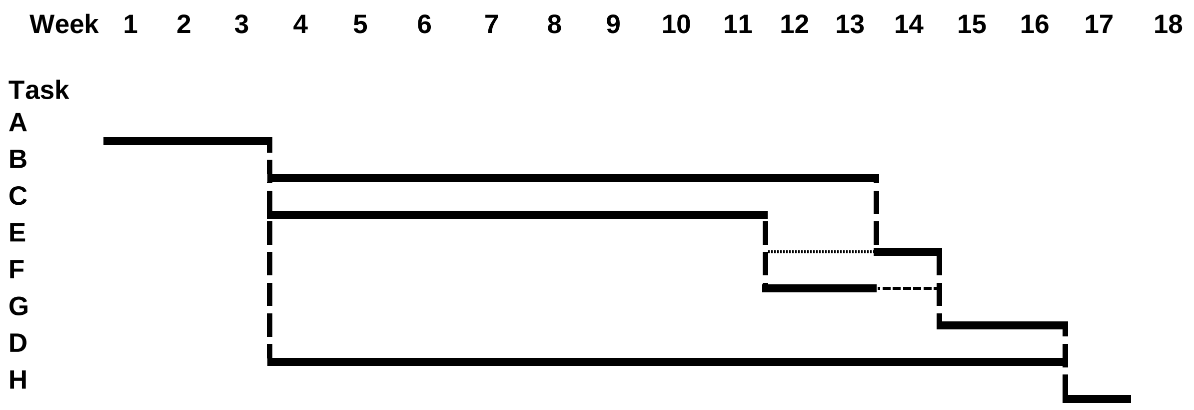
Marks were awarded for:

Diagram (none for an activity–on-arrow diagram)
Values (as above)
Highlighting (on the diagram) and naming the CP (ABEGH)
Correct stated duration of 17 weeks.

b) A number of consequent changes to the diagram should be listed or highlighted:

i) the values for LST, EFT, LFT, float and duration of task D
(it is important that all such values are always considered to be part of an A-on-N diagram, as noted in part b below)
ii) a new (second) critical path ADH (also of 17 weeks' duration)

c) A Gantt chart was expected, similar to:



with the two critical paths highlighted in some way.

Marks were awarded for correct layout, structure, durations, dependencies, floats, and both critical paths

d) The advantages of a **Gantt chart** could include:

- easier for senior management to understand
- timescales, holidays, etc are shown more clearly
- progress can be shown more simply
- better for resource allocation
- easier to show task breakdowns.

in comparison, the advantages of an **Activity-on-Node diagram** could include:

- it displays **all values** for each task
- it shows dependencies more clearly
- it is easier to re-work if there is a change in duration or dependency
- the highlighted critical path is easier to see.

Examiners' Comments

a) Nearly all candidates produced a reasonably accurate and correct Activity on Node diagram, though some reverted to some form of Activity-on-Arrow diagram.
Many candidates provided a separate table of values. It is always preferable to incorporate the values within the Node box (with a key and using one of the standard notations as set out in the suggested course texts).
The most frequent problems were the calculation of EFT and LFT (often omitted) and float; and some diagrams included dummy tasks (which are not valid for an A-on-N diagram).

b) Many candidates realised that the change in task D's duration would result in an additional critical path, but a significant number did not then answer the question fully. The question asked for ALL changes to the A-on-A diagram, and these include the LST, EFT, LFT, float and duration values for task D, as well as highlighting the additional critical path ADH.

c) Again most answers included a valid Gantt chart, although some candidates seemed to be unaware of the correct format. Some diagrams omitted the dependency lines and (occasionally) the float.
Some candidates provided a "bottom up" diagram (i.e. with task A at the bottom) whereas a top-down approach is often easier for non-technical staff to understand.

d) The question asked specifically for some **explanation** of each of the points identified, but very few candidates provided this (and marks were not allocated accordingly).
Several candidates provide a list of several advantages for each type of diagram (where only TWO were required) and some attributed the same advantages (e.g. "easy to identify the critical path", "easier to see dependencies") to both types of diagram. Limited marks were awarded in such cases.

Question 4

You work in the IT department of a small manufacturing company and have been appointed to lead a team developing a new database system using a new development tool. The business case for this software development project has been agreed by the company management.

a) Name FOUR factors that the management might use to assess the eventual success of the project.
(6 marks)

b) For each of these factors describe at least TWO potential problems that might arise to jeopardise the eventual success of the project.
(8 marks)

c) Select FOUR of these potential problems and for each one describe what actions you might take either to:
minimise the likelihood of such a problem occurring
OR
reduce the effect of the problem on the project should it occur.
(11 marks)

Answer pointers

a) The four most usual factors by which the success of a project is judged are:
within time,

within budget,
meeting all requirements,
with adequate quality.

b) Typical potential problems per factor could include (with some repetition being allowed here across the four different success factors):

Time:
under estimation
unexpected delays (usually due to external reasons)
loss of key staff
unavailability of key staff at critical stages
the new tool is more difficult to use than anticipated
poor team morale,

Budget
some staff too inexperienced – need to train, or replace them with more costly, more experienced staff
underestimation of some task durations would lead to higher staff costs.
some costs omitted (e.g. the external support of new development tool).

Requirements
inadequate analysis
requirements too broadly drawn, lacking precision.
misunderstanding by development staff.

Quality proper checks neglected to save time!
incomplete testing
inadequate test plan
unreliability of new development tool.

c) Typical preventive actions for some of the various problems could include:
(NB note the need to distinguish between probability reduction and impact reduction)

new development tool **-** site visits and user references
staff loss - good staff management, motivation, etc
identification of a shadow for really important issues
pay/bonus for completion?
inexperienced staff – up-to-date database of staff skills, used for resource allocation
team morale - team building skills
underestimation -use more reliable/better estimating methods to suit the circumstances
product quality - ensure that the project plan has sufficient time allocated to walkthroughs and testing.

Examiners' comments

a) Most candidates provided a correct list here though some included other factors. These were acceptable provided they could be used to assess the success of the project directly upon its completion.

Some misinterpreted the question slightly and listed various project management methods and techniques that might have been used, rather than to assess the outcome of the project. Others mentioned financial indicators such as IRR or ROI, but without commenting that these can often only be validated several years after completion of the project.

Consequently some candidates encountered difficulties in answering parts b) and c) of the question.

b) In this question candidates were asked clearly to describe each possible problem (and thus how it might affect the factor concerned), but many omitted this. Some answers were not at all clear in relating the problems listed, or described, to one of the four factors identified (by the candidate) in part a.

Only two potential problems were required for each of the four success factors, but often more than two were provided in each instance.

Many answers concentrated too closely (and in too much detail, with some repetition) on issues relating to staff morale, rather than taking a broader view to include other types of potential problem.

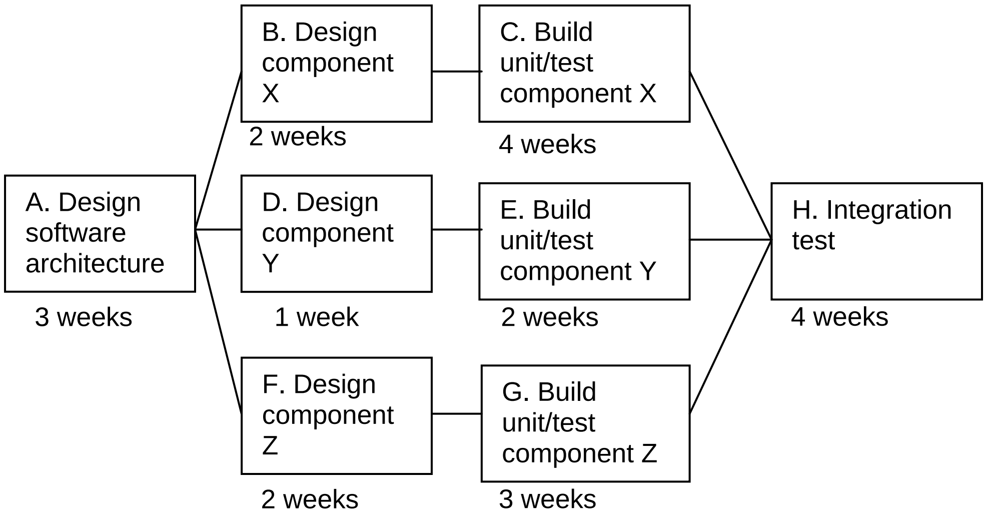
c) This part of the question was not answered well, which is worrying as it is a key element of good project management.

Many candidates failed to select clearly just FOUR of the potential problems that they had identified in part (b) and consequently suggested preventative or consequential actions that were not related directly to a specific part (b) problem. There was also clear tendency to suggest some form of improvement in pay and/or conditions (often irrespective of the actual problem as described).

There was also a continuing failure to identify clearly the difference between probability reduction and impact reduction.

Question 5

Below is shown the activity network for a small project.



The software architecture design is always produced by a lead software architect. The designing, building, and unit testing of software components is only carried out by software developers. The integration test is only carried out by a system tester.

The weekly rates for the staff available are:

Staff type	Weekly rate
Lead software architect	£1000
Software developer 1	£700
Software developer 2	£600
System tester	£500

a) Explain the process by which staff resources are allocated to the activities identified as needed for a project. **(10 marks)**

b) Illustrate the approach described in (a) above by applying it to the project above to produce a Gantt or other type of chart or table showing the staff allocated to each activity, and the planned timing of the activity. Note that only two software developers are available. **(7 marks)**

c) Calculate the staff cost of the project. **(4 marks)**

d) Discuss how you might replan the project if the lead software architect could also carry out the designing, building, and unit testing of software components. **(4 marks)**

Answer Pointers

a) Appropriate steps in allocating resources for an IT project in general could include:

- Identifying the resource types involved (noting that people within such resource type groups should be interchangeable)
- Determining the number of people available for each resource type
- Allocating the required resource types to activities
- Starting from the beginning of the project, calculating the number of each resource type needed in each time period (e.g. week) – this could be shown as a resource histogram
- Checking to see if in any time period the number of staff needed exceeds the number available (‘resource clashes’)

- Adjusting the plan to remove clashes, by, for example,
    - Allocating more staff
    - Delaying some activities – use float, extend completion date

Many other valid points were possible, and accepted, provided they were related directly to the assignment of resources to activities, or to the project in general (e.g. team building, consideration of career progression).

b) An appropriate table/diagram here could be:

Weeks >>>	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
lead s/w architect	A	A	A												
s/w developer 1				B	B	C	C	C	C						
s/w developer 2				F	F	D	G	G	G	E	E				
system tester												H	H	H	H

There are several valid alternatives to the above which gained marks.

c) The calculation of the cost of staff for the part (b) sample answer above could be shown as:

Staff type	weeks	weekly rate	cost
lead s/w architect	3	1000	3000
s/w developer 1	6	700	4200
s/w developer 2	8	600	4800
system tester	4	500	2000
		Total cost	14000

d) A possible answer would be as follows;

Weeks>>>	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
lead s/w architect	A	A	A			E	E						
s/w developer 1				B	B	C	C	C	C				
s/w developer 2				F	F	D	G	G	G				
system tester										H	H	H	H

Which reduces the project duration/completion time to 13 weeks, but increases the staff costs by £800 as shown below.

Staff type	weeks	weekly rate	cost
lead s/w architect	5	1000	5000
s/w developer 1	6	700	4200
s/w developer 2	6	600	3600
system tester	4	500	2000
		total	14800

Examiners' Comments

a) This question expected an explanation and description of the standard steps in resource allocation for an IT project, starting with the matching of available resources to the specific resource requirements for each activity. Many candidates did not describe this methodical approach at all well, tending rather to concentrate more on "team building", career progression and the cost of staff, rather than on first identifying clearly the actual resources (and abilities/experience) required to undertake each activity successfully.

b) This part of the question required a practical demonstration of the more generalised method described in part (a), and generally was answered much better than part (a).

Some tables/diagrams were not very clear (for which marks were not allocated), but most were similar to that shown above.

c) This was a quite straightforward calculation question, and most candidates showed a similar calculation method to that in the table given under answer pointers above.

d) This answer required some discussion and explanation, as well as a revised allocation table and cost calculation. Many candidates did not provide any such discussion.

An important point here is the trade-off between total staff cost and overall project duration. Some candidates did not realise that the critical path duration from the original diagram is 13 weeks, and thus it would be impossible to allocate resources in such a way to reduce this duration unless more than one resource were to be allocated to the same activity at some stage. This part of the question was set to 'test' the ability of candidates to think and apply knowledge.

Question 6

a) Explain how a project manager can use information that is generated by project control processes to identify situations where a project is late for each of the following reasons:
   (i) staff originally allocated full-time to the project sometimes work on emergency maintenance of other applications;
   (ii) the original estimates of development effort were over-optimistic;
   (iii) the scope of the specification has been increased to add new functionality that was not originally planned;
   (iv) productivity is lower than was originally expected.

(8 marks)

b) Identity the options that are available for bringing a project back on schedule when it has been found to be late. **(10 marks)**

c) Explain when and how exception reports would be created, how they would then be actioned. **(7 marks)**

Answer Pointers

(a)
(i) Timesheets will record work actually carried out on the project and work carried out on non-project activities. The problem of non-project work bleeding resources from a project may initially be suggested when the actual effort on an activity is seen to be less than that planned.

ii) Actual effort will be greater than planned effort for many activities in this case. If measured productivity (e.g. measured as lines of code per day) is as expected this may indicate that the size of tasks is greater than expected.

iii) This is similar to (ii). The change control system will show that change requests have been accepted for the software component.

iv) Effort actually expended on a software component can be compared to the size (which could be measured in lines of code or FPs). The performance of established staff can be compared to previous records of their work. New and possibly inexperienced staff can be identified.

b)options include:

- Accepting the delay and redrafting the plan with a new completion date
- Replanning to reallocate staff who are ahead of schedule with their tasks to tasks that are behind
- Bringing in additional resources – this will increase costs
- Reducing project scope i.e. obtain agreement to deliver less
- Reducing quality and increase risk – by reducing testing for example
- Using off-the-shelf components rather building them
- Using an incremental delivery approach to stagger deliverables, some might be come earlier than originally planned but others would be later.

1 or 2 marks awarded for each option depending on the amount of explanation.

c) When developments occur which mean that the project will no longer meet its commitments as far as promised deliverables, deadlines, cost or quality requirements then the project manager should write an exception report explaining the cause of the 'exception'.

This should contain recommendations, including, where appropriate revised plans.

The exception report should go to the project authority (which could be a project board or steering committee). The authority may accept or reject it in its current form and ask for rework.

Examiners' comments

a) This part was generally badly answered. Many candidates interpreted the question as relating to remedies that could be applied if the problem occurred rather than how these problems could be identified in the first place.

b) A common failing that course providers may wish to note was the misapplication of the idea of productivity – many candidates, for example, used 'high productivity' interchangeably with 'high output'. While related concepts, they are not identical: adding more staff to a project may increase output (measured in lines of code) but not productivity (measured in lines of code per staff-day).

c) Candidates understood exception reports and this part of the question was usually answered satisfactorily.