THE BCS PROFESSIONAL EXAMINATIONS
Diploma

April 2006

EXAMINERS' REPORT

Project Management

General

The number of candidates selecting this module fell this year. The answers given by many candidates clearly demonstrated they had not covered the material contained in the syllabus.

An indication of the points expected by the examiners is given below, together with some comments, to assist candidates in future examinations. Any point which was valid and relevant to the question received marks.

Question 1

1. United Electricity is a utility company that generates and distributes electricity to consumers. One of its departments is Customer Services which carries out processes relating to consumers of electricity, in particular billing and the collection of payments. Until now, Customer Services has been able to buy in ready-made, off-the-shelf software, but now there is a need for a specially written computer application.

The management of United Electricity are concerned that, while they are familiar with the management of projects which install off-the-shelf packages, they have little experience of managing projects where new software is to be developed. They are particularly concerned about how they can control the project and ensure the quality of the products of the project.

You are employed as an ICT consultant to advise them. In your initial discussion with United Electricity the elicitation of requirements and software design have been identified as being of particular concern.

Write a memorandum to the management of United Electricity that:

a) describes FIVE possible stages in the software development life cycle (apart from requirements elicitation and software design), identifying the products of each of the stages; **(10 marks)**

b) describes the flows of documents and other products between each of the seven stages of the software life cycle in part *a)* above; **(7 marks)**

c) describes in more detail the activities that are carried out and the processes needed to control quality in the two stages, requirements elicitation and software design. **(8 marks)**

Answer Pointers (Part a)

1 mark was awarded for each of five stages and 1 for each set of products for a stage.

Stages might have included:

- Feasibility investigation – producing business case
- Requirements analysis (that follows requirements elicitation) – there could be a variety of products if something like SSADM has been used
- System design/architecture design (which is at a higher level than software design)
- Build/test – producing unit-tested software components
- Integration – producing an operable integrated system
- Acceptance – producing possible modifications, but eventually a sign-off
- Installation – resulting in an installed operational system

- Maintenance – the question refers to the 'software development life cycle' so references to post-project error correction and modification is appropriate

Examiners' Comments (Part a)

This should have been a very straightforward question to answer. Among the candidates who did less well common failings were:

- Not taking account of the circumstances of the scenario e.g. that United Utilities wanted to develop new software not buy an off-the-shelf solution
- Candidates who listed the names of stages, but did not describe them as required by the question. The examiner was looking for evidence that the candidate understood what the various activities actually involved
- Not identifying the products created by each stage

Answer Pointers (Part b)

1 mark was allowed for each of the flows, up to 7, for example:

- Feasibility study produces Business Case that is used by requirements elicitation to set scope of system;
- Requirements elicitation produces an initial requirements catalogue and data flow diagrams etc that are refined by requirements analysis
- Requirements analysis produces a user requirements document that is used by system/architecture design to set the objectives that the design must fulfil
- System design identifies software components the structure of which is decided by software design
- Software design takes the system design and specifies the processing that code/test must implement
- Code/test produces that software components that the integration process puts together into an integrated system
- Installation makes operational the integrated system etc. etc

Examiners' Comments (Part b)

There was some overlap between this section and the previous one, which has asked for products. The key word in this question was 'flows' which required that for each product identified the candidate indicate the process that created it and the processes that used it. Generally very few seemed to grasp this fully.

Answer Pointers (Part c)

2 marks were awarded for the process and 2 for the quality control for both requirements elicitation and software design. The following shows an example of the kind of material that might be acceptable.

- Requirements elicitation – activities could include:
- interviewing clients and potential users
- joint application design sessions
- observation of current processes, questionnaires etc., etc
- documentation of findings
- requirements prototyping
- Requirements elicitation – quality control processes could include:
- user review of interview notes etc
- use of very early software prototypes, screen shots, user handbooks etc that can be reviewed by users
- inspection to check completeness and consistency
- Software design

- This would depend largely in the development method that has been adopted e.g. a UML approach with use cases, activity diagrams, class diagrams etc.
- Quality control would mainly be by peer review at this stage.

Examiners' Comments (Part c)

The question when set was designed both to elicit a relatively detailed description of the general activities involved in the two processes and also those that would control quality. Many appeared to misread the question and assumed only activities to control quality were required. Some leniency was allowed for the latter interpretation as long as the description of the quality control processes was detailed enough.

The answers tended to be very sketchy e.g. 'inspections and reviews' without explaining what these involved and how they might be applied in the circumstances of requirements elicitation and software design.

A general point that emerged was that many candidates demonstrated a very sketchy grasp of what the various processes in systems development really involve. Tutors are strongly advised to make sure that candidates who have no first hand work experience of the development process make themselves thoroughly aware of what each stage means in practice. This might be a case where a visiting speaker talking through what has happened on a real project would be useful.

Question 2

2. *a)* Discuss the specific risks that could arise at the requirements elicitation and software design stages of a software development project. **(10 marks)**

b) For TWO of the risks identified above, suggest:

i) actions that could be taken to reduce the chance of the risk occurring;

ii) actions that could be taken to reduce the damage that the risk could cause when it occurs.

(15 marks)

Answer Pointers (Part a)

Examiners allocated 5 marks for risks relating to requirements elicitation and 5 for software design.

Requirements elicitation:

- wrong requirements being recorded
- incomplete requirements being recorded
- lack of agreement between users over requirements.
- changing statutory requirements
- novelty of application for users (a new requirement for the organization not based on any existing clerical procedures cf student loans)
- Software design
- wrong interface
- misunderstanding requirements
- performance issues
- 'straining computer science capabilities'
- 'gold plating'
- Etc., etc

Examiners' Comments (Part a)

Despite the original intention, some, but not much, credit, was given for generic risks (e.g. staff illness) that might affect requirements elicitation and software design. The examiners were looking for risks that were *specific* to requirements elicitation and software design.

Answer Pointers (Part b)

Examiners awarded up to 4 marks for each risk reduction and up to 3 marks for contingency actions for each of the two risks - up to a total of 15 marks; e.g. for 'wrong requirements being recorded' risk reduction could include prototyping, early user manuals, user participation and contingency could include having a time/effort/cost allowance for implementing user requests for changes

Examiners' Comments (Part b)

Not many candidates could distinguish clearly between (i) which effectively is risk reduction, i.e. avoiding the risk happening in the first place, and (ii) risk mitigation or contingency actions which attempt to reduce the impact of a risk once it has materialised. Many of the poorer answers just identified some general measures such as reviews, but did not describe activities that related specially to the risks identified.

Question 3

3. A well-known national organisation has decided to replace its existing, in-house membership database with a package-based system. The choice will be made between 3 short-listed packages. An outline plan for this replacement has been drawn up, with 10 main tasks, as follows:

A	Test and select the most appropriate package	(6 weeks)
B	Modify the selected package	(10 weeks)
C	Develop system test data	(6 weeks)
D	Prepare user manuals	(4 weeks)
E	Design and develop a data migration program	(8 weeks)
F	Carry out system testing	(3 weeks)
G	Train all users	(4 weeks)
H	Test the data migration program	(4 weeks)
I	User acceptance testing	(3 weeks)
J	Implement the replacement database system	(1 week)

Tasks B, C, D and E are all dependent on task A.
Task F cannot start until tasks B and C are both completed.
Task G cannot start until tasks B and D are both completed.
Task H is dependent solely on task E.
Task I cannot start until tasks F, G and H are all completed.
Task J is dependent solely on task I.

a) Draw an Activity on Node diagram for this project, showing all dependencies and the earliest start time, latest finish time, duration and float for each task.

Highlight the critical path and calculate its duration. **(12 marks)**

b) At the end of task A it is realised that task B can be reduced from 10 to 5 weeks, but task F should be extended from 3 to 6 weeks.

In order to reflect these two changes you are required to re-calculate ALL the earliest and latest start and finish times, the floats and to identify all the changes to the critical path. **(8 marks)**

c) In some circumstances a Gantt chart might be used as an alternative to a network diagram.

i) Provide a brief explanation of two advantages of using a Gantt chart when compared with a network diagram.

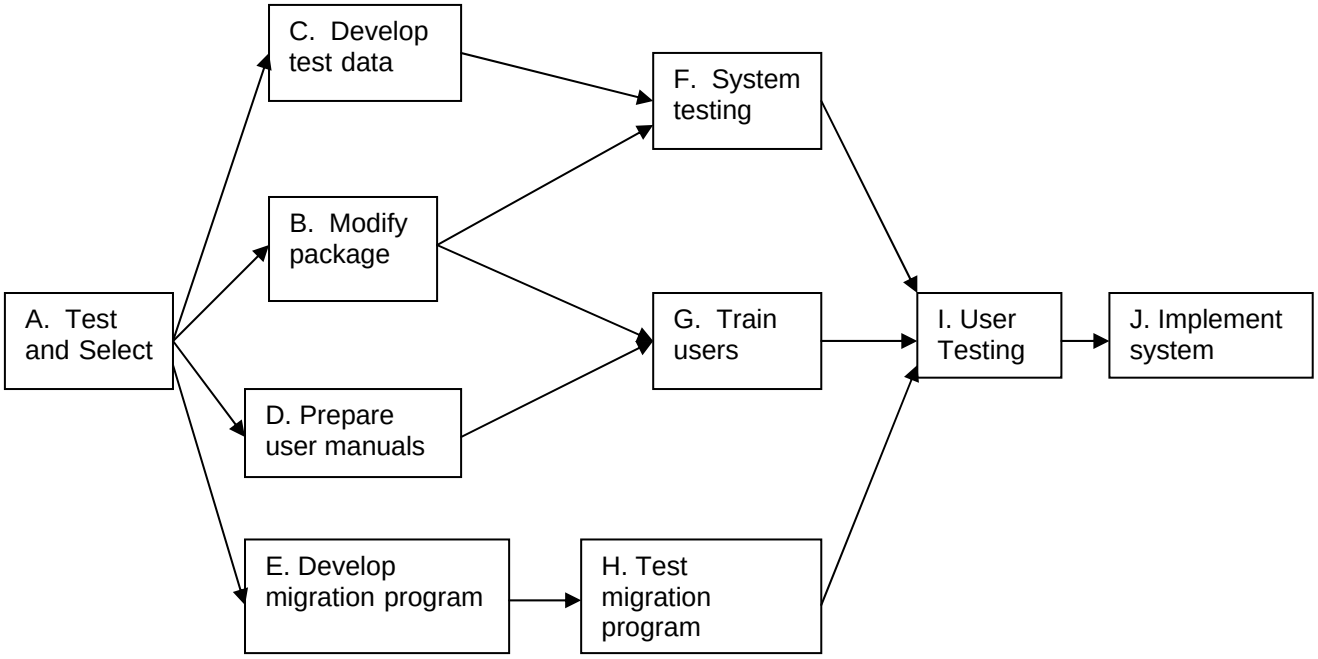
ii) Provide a brief explanation of two advantages of using a network diagram when compared with a Gantt chart. **(5 marks)**

Answer Pointers (Part a)
11 marks were awarded here for an Activity-on Node diagram (as over) showing all the correct dependencies and displaying the all the correct required values within each node, together with a highlighted critical path. The remaining 1 mark was for correctly stating the duration as 24 weeks.

The syllabus recommends BS6046 for A-on-N diagrams but this was not considered to be essential for full marks, provided a key was included for any alternative A-on-N convention.

Part marks were awarded for:
a correct diagram, but with no values displayed within the nodes;
separate lists of these required values;
naming, but not highlighting in the diagram, the critical path.

Basic A-on-N Diagram:



10 nodes, (start and finish nodes were not considered essential), but all dependencies needed to be shown.

The values to be shown on diagram (no specific notation method) are:

	EST	LFT	Duration	Float
A	0	6	6	0
B	6	16	10	0
C	6	17	6	5
D	6	16	4	6
E	6	16	8	2
F	16	20	3	1
G	16	20	4	0
H	14	20	4	2
I	20	23	3	0
J	23	24	1	0

Critical path	A, B, G, I, J
Duration	24 weeks

Examiners' Comments (Part a)
The correct answer here required a straightforward A-on-N diagram, preferably using the BS6046 node notation.

A large proportion of candidates seemed unclear of the basic principles of an A-on-N diagram and provided various forms of hybrid A-on-A/A-on-N diagram.

Many of these hybrids displayed the task durations along the arrows, rather than within the nodes, though in most cases the dependencies (and often the critical path and duration) were calculated correctly.

Very few candidates realised that the diagram could be drawn with no "crossing" dependencies if Node C was placed above Node B.

The float for task C proved difficult to calculate correctly.

Most diagrams were drawn correctly to show tasks being carried out in order across the page (from left to right), but some were drawn to flow down the page, or diagonally across, or (occasionally) in a confusing variety of directions.

Answer Pointers (Part b)
Full marks here for the following revised calculations:

	EST	LFT	Duration	Float
A	0	6	6	0
B	6	12	5	1
C	6	12	6	0
D	6	14	4	4
E	6	14	8	0
F	12	18	6	0
G	11	18	4	3
H	14	18	4	0
I	18	21	3	0
J	21	22	1	0

With **two** new critical paths
A, C, F, I, J and
A, E, H, I, J
And a revised duration of 22 weeks

Examiners' Comments (Part b)
Answers for this part were, disappointingly, very mixed as the underlying re-calculations were quite straightforward. Candidates who had provided a correct A-on-N diagram found less difficulty with this.

Many candidates failed to answer the question fully (omitting to state the new duration), nor did many appreciate that there could be more than one critical path (all tasks with float = 0 must be on a critical path).

Answer Pointers (Part c)
Typical advantages can be:

Gantt chart over Network diagram:
- Can be drawn to scale, showing relative durations
- Easier for non-technical management to understand
- Easier to demonstrate (quickly) the effect of delays

- Easier to record/display progress to date (especially part-completed tasks)
- Easier to help with and display resource allocations and possible clashes
- Easier to show working weeks and allow delays for holidays, etc

Network diagram over Gantt chart:

- Easier to show the calculated EST, LST, EFT, LFT values (and float?)
- Easier to show clearly task dependencies
- Easier to recalculate values (eg if durations change)

Up to three marks were awarded for a 2 good sets of 2 valid advantages, with a further 2 dependent on the quality of the brief explanations.

Examiners' Comments (Part c)

Some disappointing confusion here, particularly concerning the key advantages of the Gantt chart when senior management understanding or resource allocation is involved. There were very few good explanations; indeed the required (brief) explanations were very often omitted completely.

Question 4

4. A commercial organisation currently uses an outside agency to carry out all processing related to its payroll. Each month the organisation sends details of staff who have joined or left the organisation or who have changed their payroll status, for example, by being promoted. The outside agency then updates the payroll database and carries out all the other procedures such as the production of payslips and bank credit transfers.

The organisation has decided to bring this processing in-house. An existing payroll package is to be used, but will need considerable modification to deal with the organisation's requirements.

a) Identify the major costs that would be incurred by this project. **(12 marks)**

b) Explain the difference between the top-down and bottom-up approaches to estimation and discuss which would be the most appropriate approach in the scenario above. **(6 marks)**

c) Explain the nature and purpose of the Business Case report and how the estimates of the costs in *a)* above could be used in such a report. **(7 marks)**

Answer Pointers (Part a)

Full marks were awarded here for a relatively standard list that could include costs from at least 6 of the major areas listed below. Candidates were expected to realise that, in addition to the more usual costs relating to the development and implementation of a new in-house system, this particular project would require the setting up of an in-house payroll department, with associated requirements for offices, staffing etc, and (probably) increased security.

Typical costs could include:

- Staffing – both for development (a candidate could identify the types of task that would need to be carried) and operation
- Equipment: work-stations, networks etc.
- Increased physical and data security (for a payroll application)
- Software licences
- Office space, office furniture etc
- Services e.g. for software supplier to modify application; HR to recruit staff
- Data transfer and system implementation (eg probably parallel running for a payroll application)
- Training etc.

Examiners' Comments (Part a)
On the whole this part of the question was answered well, with some sensible, comprehensive lists of different types of cost.

Some candidates added the ongoing cost of consumables (such as payslips), others mentioned possible legal costs (assuming that the outside agency would require some payment for termination of the processing contract).

The first of these was considered to be relatively low cost; the second relatively unlikely.

Answer Pointers (Part b)
4 marks were awarded a correct definition and full explanation of top-down and bottom-up approaches
Top-down – an overall figure is derived for the project as a whole, which could be based on previous similar projects, **and** this global amount is then distributed between component activities
Bottom-up – the project is broken down into activities, and then sub-activities, until tasks that one person could carry out in 1-2 weeks are identified; the costs of the bottom level estimates are then **aggregated** to obtain an overall figure.

A further 2 marks were awarded for a sensible discussion and justification of the more appropriate method for this project. The bottom up approach is often used where there is no previous project experience to use as a basis for the estimate so it would probably be the more useful approach here.

Examiners' Comments (Part b)
Most candidates were able to provide a good basic (obvious) definition of top-down and bottom-up approaches, but then omitted to add that:

For the "top-down", the global amount is then split across the component activities,
for "bottom-up", the component low-level estimates are aggregated to provide a single total .
Disappointingly very few candidates discussed the most appropriate method for this project.

Answer Pointers (Part c)
The general purpose of the Business Case report is to examine whether the costs of the project (both developmental and operational) would be justified by the benefits that are expected to accrue **over the lifetime** of the installed application. Such benefits could come from reducing organizational costs or by increasing revenue; less tangible benefits (such as, say, compliance with new legal requirements) would need to be quantified wherever possible.

Thus the costs (as outlined above) would be assessed against all potential benefits, short-term and long-term, quantifiable and unquantifiable. Other concerns of the Business Case would include strategic fit and the risks associated with the proposed development.
5 marks were awarded for a clear explanation of the general nature and purpose, and a further 2 for commenting on the use of the above costs in this project.

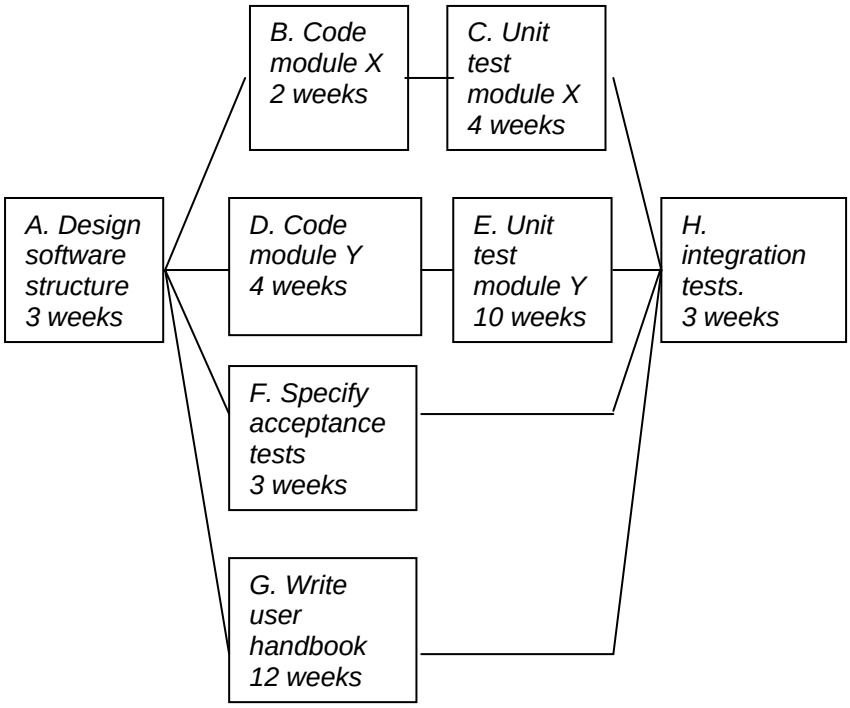
Examiners' Comments (Part c)
Overall, the standard of answers for this question was very poor. Very few candidates displayed any real understanding of the concept of a Business Case, and thus neither the nature nor the purpose of the Business Case report. Even fewer answers considered any use of the costs listed above.

Many candidates restricted their view to only the development and implementation phases of the project – some describing project plans or project progress reports, others the end-of-project review.

Question 5

5. *a)* Describe the process by which a project manager allocates staff to a project after the activity network has been produced, explaining how this might lead to changes in the structure of the plan. **(12 marks)**

b) Demonstrate the process described in part *a)* above by allocating the staff below to the activities in the initial activity network for a small project, details of which are shown below. (Assume that only one person is to carry out each task). Explain the reasons for each decision made.



Staff details

Staff type	Staff member	Experience	Cost/ week	Notes
Systems designer	SD	4 years	£600	Was formerly a software coder
Software coders	SC1	3 years	£400	
	SC2	12 weeks	£150	Allow 50% of normal productivity
Systems assistant	SA	2 years	£200	

(13 marks)

Answer Pointers (Part a)

The process might include:

- identifying the type of staffing resource needed for each activity (e.g. business analyst)
- calculating the number of staff of each resource type required in each time period (weeks in the example below), assuming each activity starts as soon as possible
- comparing the staff required each week with the staff actually available and thus identifying 'resource clashes'
- resolving resource clashes by delaying activities using float, or where this is not possible by putting back the completion date for the project. An alternative to this would be to buy in additional staff (at an additional cost)

- within groups of particular specialists allocated individuals to activities – task durations might need to be adjusted to take account of differences in productivity between different staff
- adjustments might also be made to maximise the percentage staff utilisation and to smooth out the demand for resources over the duration of the project, rather than having peaks and troughs.

Examiners' Comments (Part a)
Many candidates were clearly unfamiliar with the stage of planning, after the initial activity network has been created, where staff and other resources are allocated to activities and adjustments have to be made to remove resource clashes. Some described taking account of individual staff skills and qualities in allocating staff to tasks, but fewer explained how the such decisions might lead the need to change the plan.

Answer Pointers (Part b)
Marks were awarded for:
- allocation of appropriate specialists to activities
- showing awareness of impact of critical path when allocating resources
- making adjustments to cater for differences in productivity (e.g. with SC2)
- balancing costs against duration (and if considering extending duration of project to reduce costs).

One acceptable answer might be as in the table below where each row relates to a staff member and each column to a week. The intersecting cells show the codes for the activities to which the staff member has been allocated. There was no one right answer to the problem.

Not only did staff have to be allocated to activities and the plan be adjusted where necessary, but an explanation of the decision-making process was expected.

Weeks >	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SD	A	A	A	G	G	G	G	G	G	G	G	G	G	G	G		
SC1				D	D	D	D	E	E	E	E	E	E	E	E	E	E
SC2				B	B	B	B	C	C	C	C	C	C	C	C		
SA				F	F	F	F										

Examiners' Comments (Part b)
Very few candidates produced anything like a full answer to this question. Some allocated staff to activities but did not take account of situations where staff were then scheduled to carry out two tasks at the same time. Most did not take account of the need to allocate extra time for the inexperienced SC2.

Clearly this is a topic that should be carefully studied in conjunction with the key technique of critical path network analysis.

Question 6

6. *a)* Name FOUR criteria by which a project can be judged a success. **(4 marks)**

b) Your company has decided to develop a new in-house computer system and the project plan has been prepared.

Explain briefly the FOUR key steps (which might then be repeated) in the project control life cycle. **(5 marks)**

c) A project board has been set up and will meet monthly. You are the project manager and must prepare a report for each meeting.

List and briefly describe EIGHT different types of information that you might expect to include in each such monthly report. **(8 marks)**

d) Select FOUR items from the list that you have supplied in part *c)* above and for EACH of these four items briefly discuss:
i) ONE specific problem that might have arisen;
ii) actions that the project board might take to rectify the situation. **(8 marks)**

Answer Pointers (Part a)

A full 4 marks for:

- Completed to schedule
- Completed within budget
- Meeting all requirements (or perhaps fulfilling the business case)
- Providing proven or adequate quality

Examiners' Comments (Part a)

This was a very straightforward question on the four key factors that mark a successful project. Most candidates answered correctly, though some provided much more description than had been asked for, and others tended to consider the use of good project management methods and techniques to be **success** criteria rather than a successful outcome.

Answer Pointers (Part b)

The expected four key steps of the project life cycle are:

- Monitor progress (time, cost and deliverables) against the plan
- Compare actual progress with planned progress
- Identify variations from the plan
- Take any appropriate corrective action at this stage.

3 marks were awarded for naming, correctly, the four 4 phases with a further 2 marks for the quality of explanation, emphasising the need to identify variations from the plan quickly and to then take sensible, and speedy, corrective action.

Examiners' Comments (Part b)

Very few candidates indeed understood these basic elements of the project **control** life cycle. Most answers concentrated on, and listed, various standard phases of (computer) project development.

Some candidates discussed some important project management methods, but did not then develop these to demonstrate how they might be used to control the project.

Answer Pointers (Part c)

The full 8 marks were awarded here for listing (5 marks), and then describing (3 marks), the requested eight distinct different information types, which could include some from the following list:

- Progress to date against plan
- Expenditure to date against budget
- Use of resources to date
- Milestones achieved
- Deliverables produced
- Reasons for any variations from plan/budget to date
- Recommended corrective action
- New issues/problems
- Unresolved issues/problems from previous months' reports
- Review of risks, and changes to risk assessments
- Staffing issues
- Any anticipated issues/problems
- Anticipated progress and deliverables for the forthcoming reporting period
- Actions/decisions (especially by Board members) required now and/or during forthcoming period.

Variations of a single information type (such as progress against the project plan, which could be broken down further into "tasks started but not finished on time", "tasks not started on time", etc) were treated as a single information type in this context.

Examiners' Comments (Part c)

On the whole this part of the question was answered well, despite the frequent tendency to divide "progress against project plan" into further sub-sections.

Some candidates included much lower level information (such as individual time sheets) that would normally be handled by the project manager, not the project board. Others provided a meeting agenda (including minutes of the last meeting, and any other business) instead of concentrating on types of information to be presented to the meeting.

Answer Pointers (Part d)

Up to 2 marks per "sensible" problem (ie one that a project manager would expect to raise in such a monthly report to the board) with an appropriate (probably board level) action/decision.

Examiners' Comments (Part d)

This part of the question required candidates to assess both the type of specific problem that might be raised at such a (monthly) project board meeting and the type of action that might then be initiated or agreed, after due consideration, at this level. Many answers lacked this degree of focus, both for a specific problem and the resultant board action.

The most frequent information type raised here was a delay in project schedule, but candidates tended to quote the specific causal problem to be either a lack of adequate staffing, or a lack of staff productivity rather than more common practical problems, such as underestimation of key tasks, or some unexpected complexity.

Where delays were due to a lack of key skilled staff It was nearly always assumed that the project board would either recruit or allocate more staff, irrespective of any consideration of practicality or cost. Other, more likely decisions/actions, such as accepting the delay or re-assessing priorities, were rarely mentioned.

Problems relating to staff productivity were frequently quoted as being due to “lack of motivation” and then resolved by introducing “job rotation”. In fact it is unlikely that such an action would be appropriate in a development project of the type described, nor would the project board itself be likely to make such a decision in this context.