

**THE BCS PROFESSIONAL EXAMINATION
Diploma**

April 2004

Examiners' Report

PROJECT MANAGEMENT

General

The number of candidates selecting this module dropped this year by 27%. However those candidates who sat the examination were better prepared than last year and the overall pass rate rose from 58% in 2003 to over 70% this year with an average mark of 45%.
An indication is given below of the points expected; however any valid point, which was relevant to the question, received marks.

Question 1

1. An organization is planning to implement a computer-based human resources (HR) management system.
- a) Discuss the advantages and possible problems that the managers of the organization would need to consider when deciding whether to obtain an off-the-shelf (OTS) package, rather than developing the application in-house. **(12 marks)**
- b) Outline SIX major stages involved in a project which is to acquire and install an OTS package for the HR management system. In your outline identify some of the activities involved in each stage. **(13 marks)**

Answer Pointers

a)

The factors that would favour OTS include:

- fixed price
- as same package sold to many people may be economies of scale - lower price
- can see package in operation
- immediate delivery - do not have to wait for the solution to be developed
- expertise in using the package is more readily available both from the supplier and on the general market

The disadvantages of OTS include:

- customer still needs to do many tasks such as requirements analysis
- a package may not meet organization's precise requirements - you may need to either customize the system or build add-ons
- you have the same application as other people: it will not give you a competitive advantage
- you are dependent on outside suppliers for upgrades - as you are tied to the supplier these might be expensive
- risk that supplier ceases trading etc.

Other very valid points could be made and would obtain credit.

1 or 2 marks for each valid point up to a maximum of 12 marks

b)

The precise grouping of activities into stages could vary, but might be thus:

1. Formulation of business case - to establish economic case for new OTS
2. Requirements gathering - identifying what the current processes are; what the current ICT provision is, what the operational requirements are
3. Package evaluation and selection: identifying potential suppliers and products; checking the features of each product against organizational requirements
4. Customisation/integration. Package may need to be configured for use in the particular organization. Additional elements of software may need to be developed at the front-end or to integrate with other applications in the organization.
5. Training
6. Installation - including data take-on or transfer from old system.

1 mark for each valid stage, plus 1 or 2 marks for activities in the stage up to an overall maximum total of 13 marks.

Examiners' Comments

The most popular question with a pass rate of 81% and an average mark of 12.5.

Section (a) was generally well answered. Some candidates, not unnaturally, answered the question by addressing the advantages and disadvantages of COTS and then the advantages and disadvantages of in-house development. This was not incorrect, but could lead to a duplication of points as a disadvantage of COTS could be an advantage of in-house development and vice versa.

Section (b) was also mostly answered well but some incorrectly reproduced a life cycle where software was being produced from scratch. Another problem for some candidates was that they listed odd activities that might be carried out rather than more substantial groupings of activities that might merit the description of a 'stage'.

Question 2

2. a) Explain the differences between top-down and bottom-up effort estimating, illustrating your answer with examples of each. (10 marks)
- b) *"Function point analysis is primarily a method of measuring the size of a computer application, while COCOMO models the productivity that might be expected in a particular project. As such they can be used as complementary techniques."*

Explain what is meant by the above statement, and discuss the extent to which you might agree or disagree with the statement. Your explanation should identify the key elements of the two approaches. You do NOT need to provide precise details of the calculations used in function point analysis or in COCOMO unless the details are required to illustrate a particular point. (15 marks)

Answer Pointers

(a)

Top-down: points that could be mentioned include:

- need to identify effort or size drivers for the particular type of project
- use effort and size drivers to analyse past projects to obtain productivity rates
- use size driver + historical productivity rate to derive estimate for new project as a whole
- could use analogy as alternative way of getting estimate for project as a whole
- if necessary distribute effort estimate between lower level activities

(3 marks)

Example: size drivers could be number of screens, reports and tables that are going to be in an application to be built. Find past project with about the same number of these and use overall effort figure from that project for the new one.

(2 marks)

Bottom-up: points that could be mentioned include:

- identify main activities to be carried out
- break these down into sub-activities
- break these down into sub-sub-activities as necessary, until you get to activities that are about one to two weeks in duration.
- estimate the effort for the lowest level activities and aggregate them to get an overall total for effort (3 marks)

Example: 'gather requirements' could be broken down into:

- identify key users
- arrange interviews
- conduct interviews
- document interviews
- analyse processes
- analyse data requirements (2 marks)

b)

Principles of function points (FPs) - the following points could be raised:

- count occurrences of predefined, externally apparent types of feature that an application has e.g. inputs, outputs, tables accessed
- weight the counts of types of feature to take account of the relative difficulty
- total the weighted counts to get an overall index value of the 'processing' size of the application
- the FP count can be used to obtain productivity rates as, for example, FPs per week
- FPs can be converted to estimated lines of code (LOC) using historical information
- FPs can be counted for new application then historic productivity rate used to get estimated effort (6 marks)

Principles of COCOMO - the following points could be raised:

- uses LOC as primary task size input (or FPs which are converted to ELOC i.e. 'equivalent lines of code')
- diseconomies of scale in larger projects reflected in use of an exponent
- type of project ('organic', 'embedded' or 'semi-detached') influences productivity
- effort multipliers for different influences on productivity (e.g. experience of staff) (6 marks)

General discussion points e.g. could use FPs as front end to COCOMO
(3 marks)

Examiners' Comments

The least popular question with only a 31% pass rate and an average mark of 8.

Section (a) a tricky question for many as the term 'bottom-up' is misleading as the first part of this approach is often in fact a top-down analysis of a project into component and then sub-component activities.

Section (b) was generally very poorly answered. Several candidates who attempted this question clearly had no concept of either COCOMO or FP's which was discouraging given the prominence that these models have in the syllabus.

Question 3

3. a) Explain the difference between quality control and quality assurance. (4 marks)
- b) Describe the different types of testing that might be used during a project to develop and implement a new software application. Explain how each type of testing contributes to the overall quality of the project's deliverables. (12 marks)
- c) List and briefly explain the activities, apart from testing, that could be used to ensure the quality of the intermediate and deliverable products of a software development project. (9 marks)

Answer Pointers

a)

Quality control - techniques and activities (e.g. testing) used to ensure that products meet quality criteria

Quality assurance - planned, systematic pattern of all actions needed to provide adequate confidence that product or service meets quality requirements.

A key distinction is that quality assurance is broader than quality control which tends to look only at post production checks.

up to 4 marks.

b)

Types of testing might include:

- unit testing by software developers, basically debugging their code
- white box (or glass-box) testing carried out by programmers who are aware of the internal structure of the code and who wish to check each pathway works correctly etc.
- black (or closed box) testing - often used by specifiers or external designers to check specified functions have been included correctly
- integration testing - to check components of software work together well
- performance/volume testing - to check that response time is satisfactory when volume of use is at a realistic operational level
- interface testing - to test the usability of the application

1 mark for each type of testing, plus 1 mark for how it contributes to overall quality to max of 12 marks.

c)

other activities might include

- reviews, walkthroughs of intermediate products (including test plans)
- ensuring the competence of staff (e.g. by using professionally qualified staff)
- reference checking of suppliers
- use of prototypes
- measurement of intermediate products and processes (eg defects found and removed by inspections)
- setting and adherence to standards and procedures (eg adoption of ISO standards)
- use of configuration management, change control

up to a maximum of 9 marks

Examiners' Comments

Almost half the candidates who selected this question reached a pass standard and an average mark of 10.

a) Few candidates provided definitions of QA and QC which made it clear that quality assurance is broader than quality control, in that QA occurs throughout the project whereas QC tends to be more often employed at the post production phase and thereafter.

Many candidates derived definitions for QA and QC from the words "assurance" and "control". This approach often failed to result in correct definitions or identify this key distinction.

b) This part of the question, based on software development, required a brief description of each type of testing identified, together with a clear explanation of how each type of testing could contribute to the quality of the eventual software product.

Most candidates were able to provide lists of different types of testing, but the definitions were not always accurate, and an explanation of the contribution to quality was often omitted (thus losing up to 50% of the total of 12 marks – up to 2 per testing type).

c) In this part candidates were required to identify **other** activities, such as those given in the answer pointers above. Most candidates listed various types of review (design, code, etc) but many answers were restricted to this type of activity, whereas (ideally) a broader range was expected. Again the contribution to quality was not often explained clearly

Question 4

4. A commercial enterprise, 'Company X', is to implement a new computer-based accounting package that will replace an existing out-of-date system that had been developed internally. The new application will be provided by an outside software supplier, 'Company Y', who will customize a standard product in order to meet the particular functions required by 'Company X'. A project is to be set up which will include the modification of the application and its installation. The end of the project will be when the system is first used operationally.
- a) Identify and explain the management roles, project organization and the relationships between the different management roles and organizational units which will be required for this project. **(8 marks)**
- b) Apart from the management roles identified in a), identify the other groups of people (in both Company X and in Company Y, or elsewhere) who might be involved in implementing the project, for example in technical roles. Where necessary make clear the nature of the tasks they would undertake. **(9 marks)**
- c) Specialists together with staff from different departments and from other organizations have to be brought together to work on the project. Identify FOUR obstacles to effective team working and explain how they could be overcome. **(8 marks)**

Answer Pointers

a)

Among the points that might be made are:

- need for a project authority (project board or steering committee) which is the custodian of the business case
- steering committee would be chaired by a senior representative of the business who would have the authority to sanction financial decisions
- committee would have representatives of user groups, and suppliers and developers
- there would be a person within organization X who would have day-to-day responsibility for running the project and who would report to the steering committee
- there would be a counter-part manager in organization Y who manages the contract or account from the point of Y

- the senior user representatives would co-ordinate those activities that need to be undertaken by the users
- the developers may need to be divided into teams dealing with different aspects of the project under team leaders who report to the project manager

a project support office might provide administrative support to the management of the project, for example, collecting and processing timesheets, recording the completion of activities

Allow 1 mark for each pertinent, non-overlapping, point made up to a maximum of 8.

b)

The aim here is to assess the candidate's general awareness of the wide range of different staff who might be involved in the implementation of a computer system in a commercial enterprise.

Among the people that would be involved in non-management roles there might be:

- users of various types who would carry out tasks such as provided requirements, acceptance testing, data transfer
- trainers - to train staff in using the new application
- technical writers to produce user manuals on how to use the software in this particular environment
- hardware/network equipment suppliers if additional equipment is needed for the software to run on
- IT support - installation of platforms, installation of software
- programmers etc - to develop front-end/back-end applications and bridges which would allow the package to be integrated with other software components in this environment
- accountants/auditors to ensure that accounts balance when transferring financial data from old system to new
- legal experts - to deal with contractual matters
- HR staff - to deal with any changes to the pay and conditions of service of staff resulting from changes in working practices

Up to 9 marks will be awarded depending on the candidate's range of awareness of the job roles that might be involved.

c)

obstacles to effective group working might include:

- Tuckman's phases of team integration i.e. forming, storming, norming, performing
- conflict of interests: one group's benefits might be at the cost of extra work for some other group
- fear of loss of autonomy
- personality clashes
- role uncertainty etc.

up to 4 marks

measures to overcome these obstacles might include:

- team-building exercises
- briefings on organizational needs and objectives to reduce misconceptions about the consequences of change
- top management endorsement and demonstrated continued interest
- Boehm's 'Theory W' - creating win-win situations
- bonuses etc

up to 4 marks

Examiners' Comments

Less than half the candidates selected this question and of those some 32% reached the pass standard. The average mark obtained was 8.

There were some good answers to part (a), but many candidates misunderstood the use of the phrase 'management roles' and talked generally about the things that managers did, rather than the different types of manager involved in a project. This got some credit, but this interpretation meant that the later part of the question about project organization and the relationship between different types of management roles got a poor mark.

It had been envisaged that (b) would be a relatively easy question that tested the candidate's general knowledge of the environment in which IS development projects are executed. There were many disappointing answers, candidates did not go much further than 'developers' and 'users'.

Section (c) meant easy marks for many candidates. Some, however, talked about motivation in general terms, rather than in relation to team-work. The lack of any reference to the standard models in this field in many cases was disappointing.

Question 5

5. A small research group in your organisation is being relocated to new offices. The IT section have planned the move with 8 main tasks:

A	order, deliver and install server	2 weeks
B	design and install network infrastructure	4 weeks
C	order, deliver and install PCs	3 weeks
D	test server and network	1 week
E	test PCs with server and network	1 week
F	copy database to new server	1 week
G	copy statistical software to new PCs	2 weeks
H	test PCs, all software and database	1 week

Tasks A, B and C can run simultaneously, but A and B must both be completed before D can start. Tasks C and D must be completed before E can start. E must be completed before F and G can start. F and G can run simultaneously, but must both be completed before H can start.

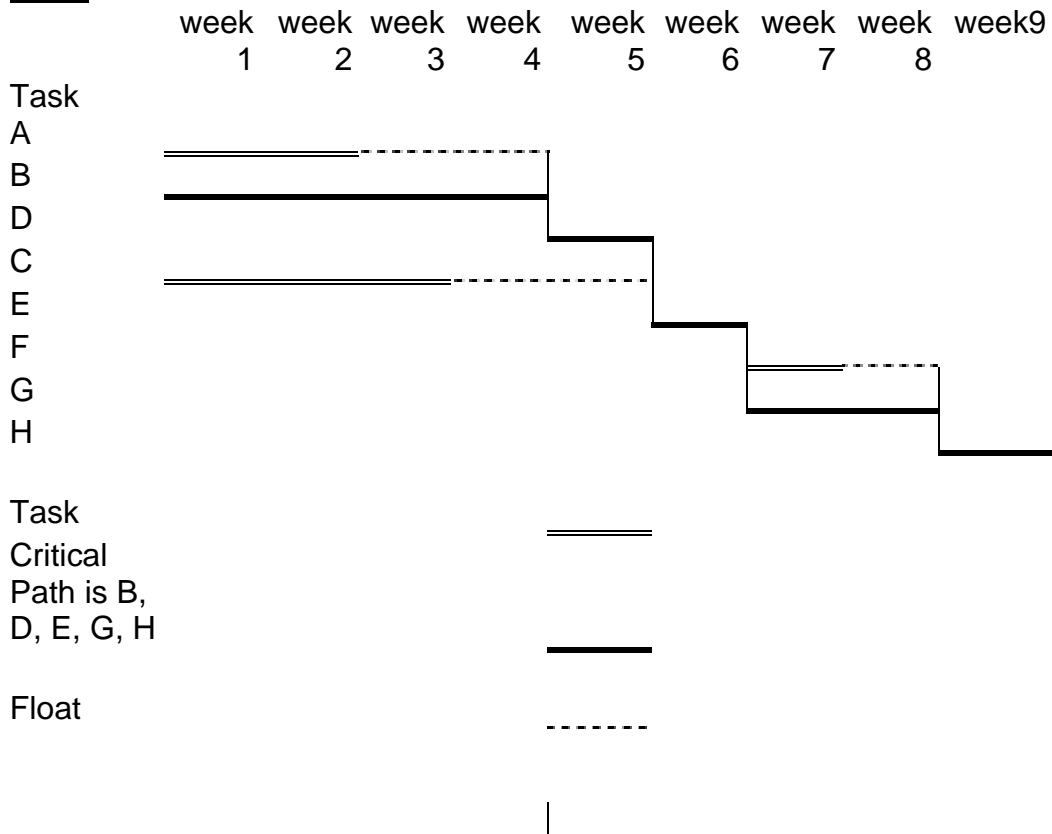
- a) Draw a Gantt chart for this project, showing each of these tasks and each task duration.
Draw a network diagram (Activity on Node) for the same project tasks, showing the earliest and latest start dates, the earliest and latest finish dates, duration and float for each task.
Highlight the critical path on both diagrams.
What is the total duration of this critical path? **(17 marks)**
- b) Briefly discuss the most significant differences between the two types of diagram used in a), highlighting TWO advantages of the Gantt chart and TWO advantages of the network diagram. **(8 marks)**

Answer Pointers

a) (17 marks)

5_a1)

Gantt



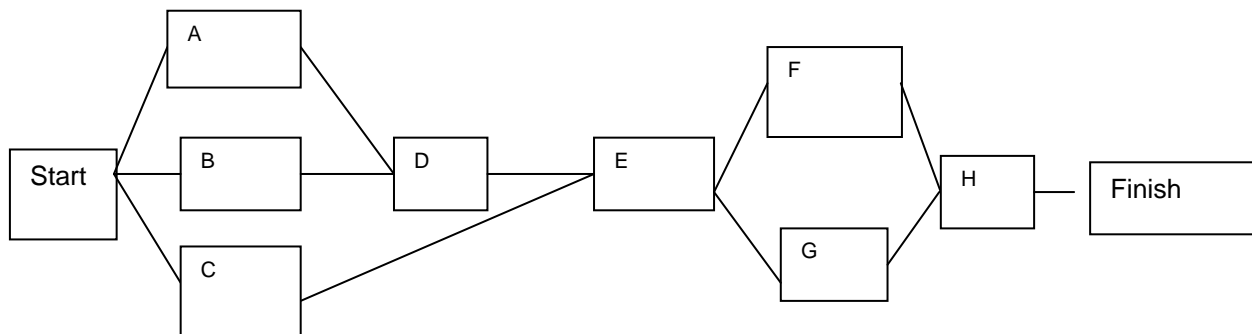
5a1) marks

Correct Gantt diagram
deduct 1 per major error
Diagram should include:

- Clear scale
- Obvious key
- Clear/correct highlighted CP
- Correct durations and dependencies

6 marks

5a2) Q5 Network



(with arrowheads)

Task	EST	LST	EFT	LFT	Dur	Float
A	0	2	2	4	2	2
B	0	0	4	4	4	0
C	0	2	3	5	3	2
D	4	4	5	5	1	0
E	5	5	6	6	1	0
F	6	7	7	8	1	1
G	6	6	8	8	2	0
H	8	8	9	9	1	0

5a2) marks Correct A-on-N, with all requested calculations, 9 marks
Deduct 1 mark per major error

Look for

Correct dependencies (incl arrowheads)	(2)
Correct calculations EST, LST, EFT, LFT	(3)
Standard format	(2)
Clear highlighted critical path	(2)

5a3) remaining marks Duration = 9 weeks 2 marks

5b)(8 marks)

Gantt advantages:

Can be drawn to scale

Easier to understand visually by “non-technicians (Managers, Board)

Network (A-on-N) advantages:

More information (eg EST, LST, float) clearly visible

Easier to see dependencies

Quicker to recalculate if durations, dependencies etc change

Marks for 5b)	Discussion	2
	2 Gantt advantages	1.5 for each = 3
	2 A-on-N advantages	1.5 for each = 3
		Total = 8

Examiners' Comments

Almost 90% of candidates selected this question of whom 70% reached a pass standard and the average mark was 12.

a) Most candidates had little problem with drawing a straight forward Gantt chart, though often the critical path was not **highlighted** (requested specifically in the question) and dependencies and float were also omitted from the diagram itself, though they had been interpreted correctly when drawing the diagram. A small proportion of answers showed all tasks starting simultaneously.

An Activity-on-Arrow network diagram (**9 marks**) was specified clearly here, yet a large proportion of candidates submitted an Activity-on-Arrow diagram instead (for which 7 or more marks were deducted, depending on the accuracy and completeness of the A-on-A diagram). There were also many hybrids. Most of these hybrids contained dummy activities and/or had durations labelled on the arrows, which are key features of A-on-A, not A-on-N.

A full answer should have included the dependencies. The 6 values per node should then have been included within each node on the diagram (together with a key to the node layout) as well as a clearly **highlighted** critical path (B-D-E-G-H).

Part b) asked for a brief **discussion (2 marks)** of the differences between the two types of diagram. This required discussion was often omitted in favour of a **list** of the key features of each diagram (without then justifying why each is necessarily an advantage). Candidates who had provided an AonA diagram were sometimes handicapped here, for instance when stating that an advantage of the network diagram is that dummy activities can be shown.

Key differences could have been that:

The Gantt diagram is a bar chart, drawn to scale and therefore indicating clearly the duration and relative timing of each activity, as well as the overall project duration.

The network diagram is not to scale, but shows dependencies more clearly and provides a more detailed analysis of the time limits on each activity.

Some more obvious advantages of Gantt were rarely mentioned, eg:

- it is more readily understood by general management
- progress to date can be indicated clearly.

Others mentioned often included::

- resource allocations can be shown, and (possibly)
- it can then be developed as a basis for resource smoothing

Question 6

6. You work for a small software house whose main work is the development and production of bespoke software systems for clients. Each such development can be for one or more clients, and each is treated as a separate project. Such projects are fully planned with the client and justified internally at the outset.
- a) Briefly outline four general reasons why a project may not be a success. **(8 marks)**
- b) Choose three of the reasons you gave in answer to part a) and for each of the three give at least one specific possible factor that could result in such an outcome. **(6 marks)**
- c) A small team is midway through a project, which is to develop new software for a prestigious client. The team leader has left, and you have been assigned the role of team leader. Your Managing Director (MD) is concerned that there have been a number of problems with the development so far, with considerable overtime being worked.
- i) Identify the information you need from the project team in order to establish the present situation and specify the methods you would use to obtain the information. **(7 marks)**
- ii) List the main contents of your initial report to the MD. **(4 marks)**

Answer Pointers

- 6a) **(8 marks)** Expected:
- Time overrun
 - Cost overrun
 - Not meeting all requirements adequately
 - Poor quality product
- 2 marks each = 8
deducting up to 2 for lack of discussion

6b) Possible factors for the four main reasons from part a) could include:

Time overrun

Staff inexperienced in the software development tools being used, (estimate assumed experienced staff)
Underestimation, poor choice of estimating methods for activity durations
Misunderstanding of client requirement
Uncontrolled scope creep

Cost overrun

Recruitment of more skilled (and costly) staff.
Could be an urgent need for a different or better system development tool
Need for overtime to keep within time schedule
Lack of reliable cost control method/recording

Not meeting requirements

Poorly specified requirements
Difference in interpretation between client and developers,
Lack of comprehensive testing
Overlooking some particular requirements

Lack of quality

Poor system/program design (too hurried?)
Poorly planned testing
Lack of program walkthroughs – poorly handled development controls
Lack of development standards within the software house, or lack of adherence to such standards.

If other reasons are given in part a, then appropriate factors (ie **not** effects or remedial actions) would be accepted fully here.

6c1) (7 marks)

The information required (5 marks) should include:

Project progress

- details of work/tasks completed to date,
- work/tasks in progress
- time required/estimated to complete tasks in progress
- actual effort expended on tasks so far
- problems encountered to date (internal and external)
- those still outstanding

Costs:

- Expenditure to date (finance section)

Working papers:

- Original plans, estimates, risk assessments etc
- Information to/from client to date

Other

- Information supplied by client to date (if appropriate)

Possible methods (2 marks):

- Timesheets – if available
- Team meeting
- Error reports
- Initial Risk Assessment
- Configuration management reports or change records

6c2) (4 marks)

Report to MD should include:

- progress v plan
- expenditure v budget
- unexpected problems overcome
- problems anticipated
- risk assessment update
- recommendations

- Beware of information overload

- Use graphical presentation wherever possible

Examiners' Comments

Almost 90% of candidates selected this question of whom 72% reached a pass standard and the average mark was 13.

a) This question expected candidates to identify, and explain briefly, the four “standard” **general** reasons:

- not completed within scheduled time (Time overrun)
- not completed within agreed cost (Cost or Budget overrun)
- not meeting all requirements adequately
- not of the required quality.

Many candidates identified other reasons, some appropriate specifically to the type of software project described in the preamble. These were acceptable provided they were still sufficiently general, and suitably explained, including:

- Lack of required skills within the small software house
- Poor initial definition
- Scope creep, lack of good change control/configuration management
- Environmental, political or similar external changes during the development period

Poor project management
Inadequate communication with, involvement of, the client
User resistance

Several candidates provided a single list of **more than four** such reasons. The additional ones were not required and received no credit.

Part b) asked for more specific factors that could **lead to** three (of the four) outcomes that the candidate had provided in answer to part a. Examiners were looking for **causes**, not **effects** (with **6 marks** in total). On the whole this part of the question was not answered well. Many students discussed here the **effects** of the “reasons” they had outlined in part a, others described methods or actions to overcome, rectify or prevent such outcomes. Reduced marks were awarded for effects rather than causes.

c) The key point here is that this is, initially, a fact-finding exercise in order to establish the current status of the project. The MD has indicated two particular concerns (“problems” and overtime) so there should be some emphasis on these as well as the more standard issues, such as progress against schedule (including progress against delivery to meet agreed requirements) and expenditure to date against budget.

Many candidates overlooked these specific points, many also omitted expenditure to date (a key issue for a such small organization). Some candidates continued to describe **actions** that the new team leader might take to overcome possible problems (for instance, often assuming that the project was behind schedule or that the team had become de-motivated) – the **question did not ask for this**, no marks were gained.

Many candidates suggested contents that included far too much detail (eg **lists** of **all** tasks completed, etc)