**THE BCS PROFESSIONAL EXAMINATION**
**Diploma**

**October 2004**

**EXAMINERS' REPORT**

**Systems Analysis**

## General

Overall question 1 is generally well answered however candidates should not assume that data flow modelling will continue to appear in the compulsory section of this paper. Candidates should be aware that with the increasing use of object technologies in the real-world, it is reasonable to expect more OO systems analysis modelling techniques to be assessed in this examination in the future. Candidates should also make sure that they read the questions carefully and answer the question as asked so as not to waste time giving information not required.

## Question 1

'Hey Presto - English Language School'

'Hey Presto' is a well established and growing English language school. The Principal has identified Information Systems as a priority for future developments. Following an initial systems analysis exercise undertaken by your colleagues you have been asked to model the processing and data for the current 'student grades' system. Your colleagues have provided you with the following information regarding the 'student grades' system:

- We record grades for two types of students; students that are sponsored by their employers and overseas students that are here on a study visa.
- Student coursework and examination marks are passed to the Office Manager by module tutors.
- Before marks can be recorded we access the student record to check that the grades submitted are for a registered student and that the grades are for a module on one of our courses. A course is made up of between 3 and 6 modules.
- If marks are provided for a non-registered student or a module that is not part of one of our courses we record the details of the invalid mark separately and pass the details to the Office Manager. We do not process invalid marks until the problem has been investigated and rectified by the Office Manager.
- Once both coursework and examination marks for modules have been recorded they are printed for checking by the module tutor.
- Once module marks have been checked and approved by the module tutor they are reprinted and presented to the Board of Examiners for their consideration.
- We send the students their approved results after each meeting of the Board of Examiners.
- We also send a copy of the student results to the employer of sponsored students.
- For overseas students we have to check that their visa is not out-of-date before releasing their results to them.

a) Draw a Top Level (i.e. the level below the Context Diagram) Current Logical Data Flow Diagram for the above scenario. (15 marks)

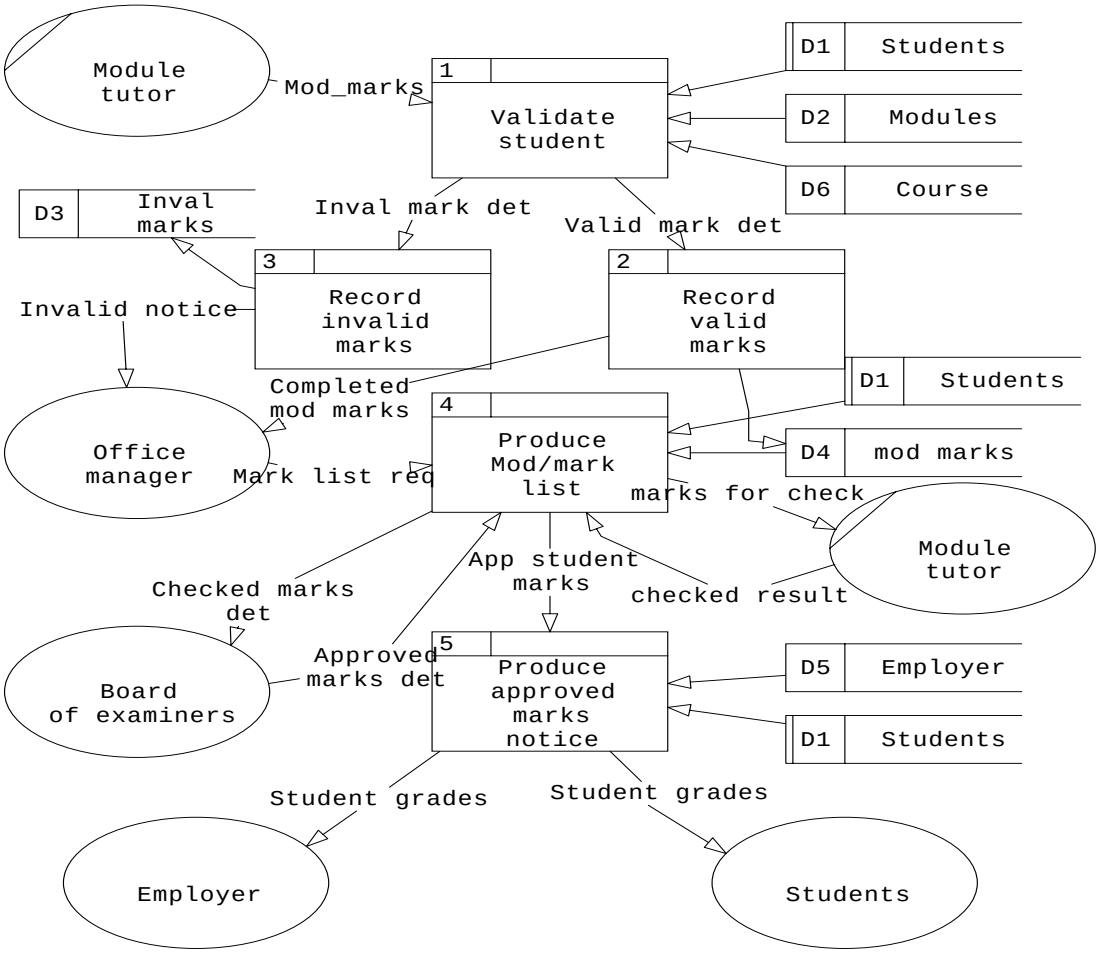
b) Produce an Entity Relationship Diagram (Logical Data Structure) and a set of normalised tables for the above scenario. You DO NOT have to show evidence of the normalisation process. (15 marks)

c) It has been decided that the system will be developed as an Object Oriented system. Sketch an initial Analysis Class Model that shows the processing and data required to support the 'student grades' system. Include any inheritance structures and aggregations that you identify. (20 marks)

**Question 1 Answer Pointers**

**Q1a) Data Flow Diagram** (other suitable notation will be accepted).

Whilst solutions showing more detail or at a higher degree of aggregation are acceptable the 5 main processes below must be shown.



**Marking Scheme:**

| | | | |
|---|---|---|---|
| Processes: | 1 each up to 5 | Data Stores: | 1 each up to 4 |
| Data Flows: | 0.5 each up to 3 | External Entities: | 1 each up to 3 |

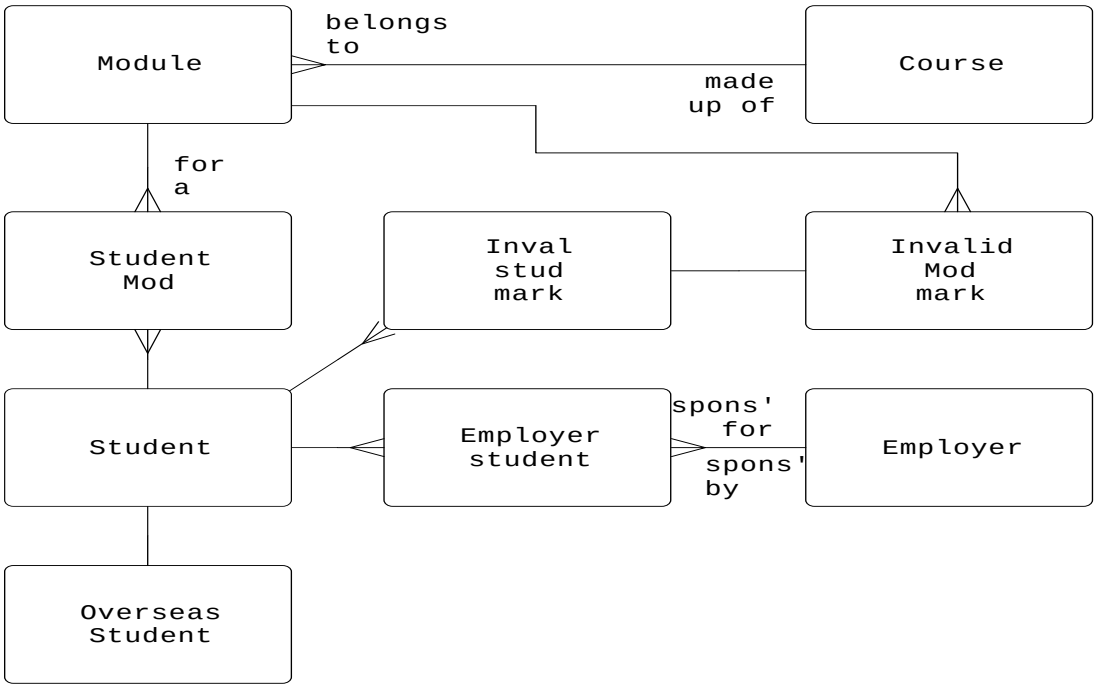
***Total Q1a: 15 marks***

**Examiner's Comments**

The question was answered quite well by most candidates with good marks being frequently awarded. Appropriate processes, stores and external entities were identified to support processing indicated in the scenario. Many candidates either failing to name their data flows at all or named them with process sounding names such as, 'send data', 'check marks', etc. Some candidates modelled processes that are outside the 'grades system' such as 'Process applications' or 'Register new student' and in doing this they were awarded no credit for their efforts. Another feature of some answers this year that is worthy of note is the attempt by some candidates to state assumptions about the processing that undermines the complexity included in the scenario. A small number of candidates stated assumptions to the effect that 'all students are registered' and 'all marks are valid'. Candidates should not state assumptions that reduce the complexity of the case study and the challenges associated with modelling it.

Overall however, this question was generally well answered. Candidates should not assume that data flow modelling will continue to appear in the compulsory section of this paper. Given the global move towards the use of object technologies it is reasonable to expect this paper to reflect this in the tools and techniques it assesses.

**Q1b) ERD (LDS)** (other suitable notation will be accepted).




**Normalised tables:**

Course (course#, c_desc, c_sdate, c_edate, c_organiser)
Modules (mod#, m_name, m_desc, *tutor#, course#*)
Student (student#, s_name, s_add, s_email, s_tel)
Invalid mod mark (imm#, inval_name, inval_mark, imm_date, *mod#*)
Inval Stud Mark (imm#,student#)
Employer student (emp#, student# )
Employer (emp#, e_name, e_add, e_contact)

Student mod (mod#, student#, sm_mark, sm_date)
Overseas student (student#, passport#, nationality, visa expiry date)
Module – tutor# is a FK reference to tutor entity (not shown) that is outside the responsibility of this sub-system.

**Marking Scheme:**

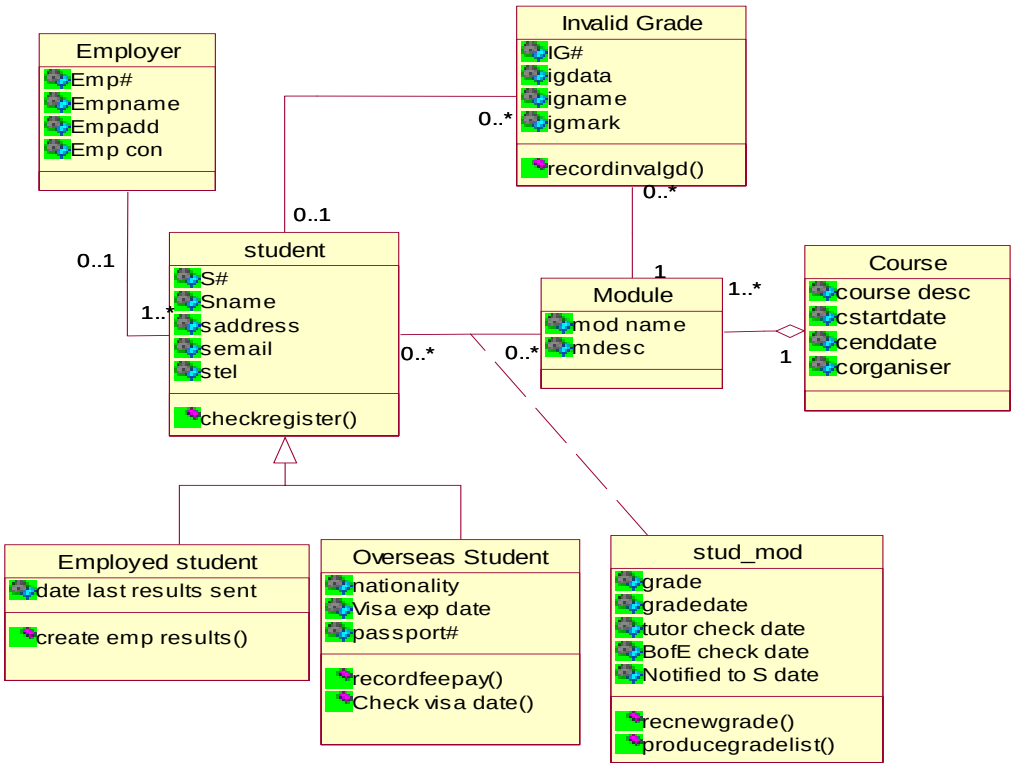
| | |
|---|---|
| Entity types: | to max of 5 |
| Relationships with appropriate degrees & membership classes: | to max of 3 |
| Table types, consistency with LDS + appropriate PK: | to max of 3 |
| FK postings: | to max of 2 |
| Other attributes to support processing and normalised tables: | to max of 2 |

***Total Q1b: 15 marks***

**Questions 1b**
**Examiner's Comments**
Again a good level of ability was displayed in response to this question. Good answers correctly identified the required entities and modelled them according to ERM rules. Most candidates added a set of basic attributes, but too few included the attributes explicitly required to support the processing required in the 'grades system'. Too often candidates simply added a set of 'common sense' data. Some of the less good answers were characterised by the following errors or misunderstandings: Over complicated models with too many entities and relationships between them.

a. Many candidates included entities such as 'Language school', 'Office manager', 'Board of Examiners' and 'Module tutor'. These are the human actors that interact with the system rather than data entities within the system.
b. Too many candidates still do not understand the Primary/Foreign key relationship.
c. Despite these persistent errors most candidates gained good marks for this part of Q1.

**Q1c)** **Analysis Class Model** (other suitable notation will be accepted).




**Note:**

1. Look for aggregation between module and course
2. Look for structure between student and type
3. Look for 'check visa date' method and attribute
4. Look for 'check registered' method and data.
5. Look for association class.
6. Look for no PK and FK from ERM – not required on analysis class model
7. Look for no navigability – not required on analysis model

**Marking Scheme:**

| | |
|---|---|
| Classes | 1 mark each to max of 4 |
| Association | 1 mark each to max of 4 |
| Structures | 1 mark each to max of 2 |
| Attributes to support processing | 1 mark each to max of 5 |
| Methods to support processing | 1 mark each to max of 5 |
| | ***Total Q1c: 20 marks*** |

**Question 1c**

**Examiner's Comments**

Of the three parts in question 1 this was the most disappointing. Only a small number of candidates were able to produce an analysis class model and even fewer were able to satisfactorily demonstrate an understanding of structures and aggregation. Most candidates did include some attributes but very few candidates included appropriate methods to support the required processing. This was particularly noticeable with regard to modeling data and methods in the 'Student' class and its sub-classes. A number of candidates simply failed to even attempt this question.

Candidates should be aware that with the increasing use of object technologies in the real-world OO systems analysis modelling techniques are likely to be assessed in this examination in the future.

## Question 2

The models requested in Question 1a and 1b represent the process and data views respectively of the system under development.

a) Identify a model used in SSADM to represent a third view of the system and illustrate the notation used by means of a general diagram.

(7 marks)

b) Explain how this third view of the system may be cross-checked against the process and data views of the system.

(4 marks)

c) Compare the approach taken to modelling data, process and time by an Object-Oriented methodology such as the Unified Process with the 'three views' approach of SSADM. (14 marks)

(Total 25 marks)

## Question 2 Answer Pointers

a) Entity Life History – **2** marks

For diagram that shows:

Inverted tree format with entity type name at the top - **2** marks

Sequence, selection, iteration notation – 1 mark each = **3** marks

b)

ELH is created for each entity type on ERD

Attributes shown in the data model must be created, deleted, amended by events in ELH

Events on ELH relate to data flows causing creation/update/deletion of data in data stores in DFD

All events that cause a change to data in DFD should be shown on ELH.

1 mark each to a maximum of **4** marks.

c)

SSADM: process, data, and time modelled as 3 different views of a system using Data Flow Model, Data Model and Entity Life Histories respectively – **3** marks

In OO methodology:

- data and processes are both modelled using a Class Diagram
- Class Diagram shows the classes in the system and the associations between them
- each class has both data (attributes) and behaviour (operations)

2 marks for these or equivalent to a maximum of **6**.

- the time (dynamic) view of the system is modelled using interaction diagrams (sequence and collaboration diagrams) and by using state transition diagrams.

Up to **5** marks for an explanation of how the dynamic view is modelled in an OO approach; no more than 3 if only one model is explained.

**Examiner's Comments**
Very few candidates answered this question; some of those who did, demonstrated little understanding of the issues. A knowledge of the features of both structured and object-oriented approaches is an important part of the syllabus.

**Question 3**
a) Define what is meant by a 'prototype' in the context of information systems development and explain how prototyping might be used during the Systems Analysis stage of a project. (13 marks)
b) Identify any disadvantages of using a prototyping approach to systems analysis. (12 marks)

**Question 3 Answer Pointers**
*a) 'Prototype' = an early working model of the system; may be a 'throw away' prototype or may be elaborated into the final working system (evolutionary prototype).*
*Up to **4** marks for this or equivalent definition.*
*Can be used during the Systems Analysis stage to:*
- *help elicit requirements from an end user*
- *improve the analysts' understanding of application domain*
- *try out & evaluate alternative approaches*

*Up to 3 marks each for these or equivalent to a maximum of **9** marks.*

*b) Possible disadvantages include:*
- *raise unrealistic expectations in users who think the time taken to produce an early prototype reflects the time/effort required to produce working system*
- *iterations need to be controlled – else danger of time overruns as prototype is increasingly refined*
- *requires user involvement – they may not have the time/inclination*
- *requires appropriate software to produce prototype*
- *may divert attention to interface, rather than functional, issues.*

*Up to 3 marks for any of these or equivalent, to a maximum of **12** marks.*

**Examiner's Comments**
This question was answered quite well. Candidates should note the marks allocation and use this as an indication of the amount of effort required for each part of the question – in some cases very little was written for part (b) as compared to part (a) despite the fact that the mark allocation is similar.

**Question 4**
a) Identify the key stages of the traditional systems development 'waterfall' lifecycle and explain why in practice these stages are rarely followed in sequence. (9 marks)
b) Explain what is meant by the term, 'Rapid Application Development' (RAD) and discuss the advantages and disadvantages of adopting a RAD approach to systems development. (16 marks)
(Total 25 marks)

**Question 4 Answer Pointers**

a) Project initiation; systems analysis; systems design; implementation; review/maintenance.
1 mark each for these or correct alternative stages = 5.
Rarely followed in sequence because:

- requirements are likely to emerge as project progresses, requiring backtracking to analysis stage – can be caused by time it takes to work through waterfall lifecycle
- design may not be feasible to implement, requiring backtracking to design stage.

Up to 4 marks for these or other relevant points.

b) RAD: approach to systems development which aims to deliver functionality quickly and often, involves incremental development. May use 'timeboxing' to ensure there are no overruns on deadlines; requirements are prioritised and the most important delivered first. Example of a RAD approach = DSDM.
Up to 4 marks for this or equivalent explanation.
Advantages include:

- responsive to business needs, where systems are required without delay to provide competitive advantage
- incremental development means knowledge about application domain grows with successive increments
- end user feedback is acquired with each release.

Up to 2 marks for each of these or other relevant points – 6 marks.
Disadvantages include:

- not applicable to all types of information system, e.g. where safety-critical or security issues are paramount
- may lead to a tendency to 'cut corners', e.g. not test thoroughly
- documentation may not be sufficiently complete to aid maintenance.

Up to 2 marks for each of these or other relevant points – 6 marks.

**Examiner's Comments**

This question and question 5 were answered by many of the candidates.
Candidates need to be sure that they answer the question; (a) requires the key stages of the waterfall lifecycle to be identified (not described in great detail – see the marks allocation); plus the specific question of why in practice the stages are rarely followed in sequence – *not* to provide all the disadvantages of the waterfall life cycle.

**Question 5**

Explain FIVE of the following terms in the context of the Systems Analysis phase of a project:

| | | |
|---|---|---|
| a) | Rich Picture | (5 marks) |
| b) | Feasibility Study | (5 marks) |
| c) | Requirements Specification | (5 marks) |
| d) | Use Case | (5 marks) |
| e) | Computer Aided Systems (or Software) Engineering (CASE) tool | (5 marks) |
| f) | 'Soft' methodology | (5 marks) |
| g) | Structured Walkthrough. | (5 marks) |

**Question 5 Answer Pointers**

a) Rich Picture
A technique used in Soft Systems Methodology.
Designed to show the 'richest possible picture' of a problem situation.
Provides an overview of the problem situation, the main stakeholders, processes, information flows.
Includes consideration of the worries, concerns of people involved.
Can help highlight any conflicts.

1 mark for each of these or other relevant points to a maximum of **5**.

b) Feasibility Study
Undertaken to determine the feasibility of a proposed systems development project.
Carried out before full Systems Analysis phase.
**2** marks for this or equivalent.
Can cover technical, operational, economic feasibility.
**3** for brief explanation of these.

c) Requirements Specification
Main document produced as output of Systems Analysis phase – **1** mark
Contents likely to include: background to the problem situation; objectives of the proposed system; detailed analysis of the user requirements; models produced as outcome of systems analysis – **4** marks for this or equivalent.

d) Use Case
A description of functionality of the system from the users' perspective.
Use Case Diagram shows the functionality the system is to provide and which users will communicate with the system to use that functionality.
**3** marks for this or equivalent; **2** marks for an appropriate diagram.

e) CASE tool
A software support environment for systems developers.
Enables models to be produced and checked for completeness and consistency.
Helps with production of systems documentation.
Automates tedious tasks such as making updates, keeping models consistent, tracking changes made.
1 mark each for these or equivalent points = **5**.

f) 'Soft' methodology
e.g. Soft Systems Methodology – **1** mark.
A methodology that says that an Information System (IS) is not a purely technical system, but is a human activity system.
It is essential to consider the organization in which the IS is to be installed and the people who are to interact with it if it is to be successful.
2 marks each for these or equivalent points = **4**.

g) Structured Walkthrough
Part of a quality check on the systems development work.
Consists of peers reviewing each others' work.
Essential to prepare for meeting by circulating the work to be considered.
Purpose is to provide constructive criticism to improve the quality of the analysis work.
Important to follow-up to ensure action has been taken to correct any errors/omissions.
1 mark each for these or equivalent = **5** marks.

**Examiner's Comments**

This was the question answered by the greatest number of candidates, and on the whole it was answered well with many candidates achieving very good marks.

Candidates should note that there is no advantage to be gained from answering more than the FIVE parts specified; only five answers will count so time spent on the additional answers would be better spent improving the five answers required.