THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 5 Diploma in IT

October 2007

EXAMINERS' REPORT

SYSTEMS ANALYSIS

Question 1

a) Draw a Top Level Current Logical Data Flow Diagram for the above scenario.

(16 marks)

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

(20 marks)

c) i) Name the diagram that can be used to model the third (time, or dynamic) view of the system.

(2 marks)

ii) Explain, using examples from your answers to Question 1 parts a) and b), how the three views of the system may be checked against each other to ensure the consistency and completeness of the analysis models.

(12 marks)

Answer pointers & marking scheme

Solutions are indicative; plausible alternatives will be accepted.

a) **Data Flow Diagram**

See diagram on separate sheet (other suitable notation will be accepted).

Marking Scheme:

Processes:	1 each up to 6
Data Stores	0.5 each up to 2
Data Flows	0.5 each up to 5
External Entities	1 each up to 3

16 marks

b) **ERD (LDS)**

See diagram on separate sheet (other suitable notation will be accepted) and table types below.

Marking Scheme:

Entity types:	1 mark each to max of 6
Relationships with appropriate degrees & membership classes:	1 mark each to max of 5
Table types, consistency with ERD + appropriate PK:	0.5 each to max of 3
FK postings:	0.5 each to max of 3
Other attributes placed to result in well-normalised tables:	3

20 marks

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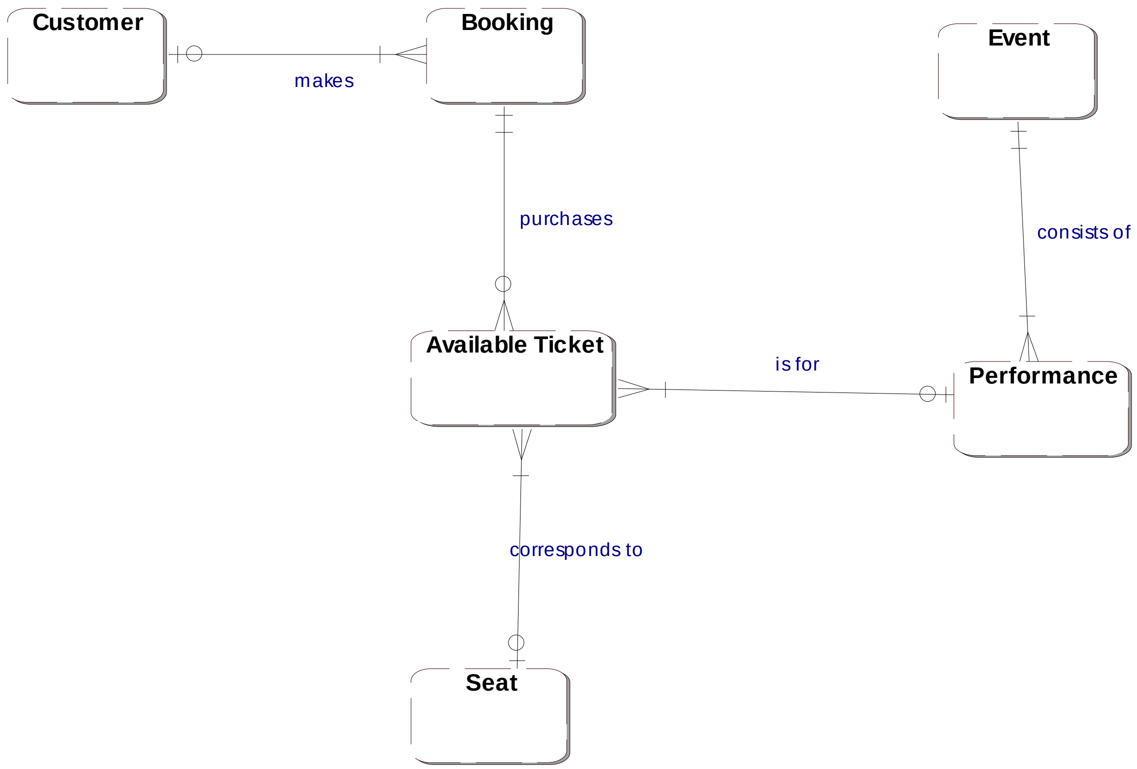
Sample Tables in BCNF

Event	(event_no, event_title, event_description, event_type, start_date, end_date, approximate_running_time)
Performance	(performance_no, *event_no*, performance_date, performance_time)
Seat	(seat_no, suitable_for_disabled [Boolean])
Available Ticket	(*seat_no*, *performance_no*, price)
Customer	(customer_no, customer_name, customer_address, customer_telephone, mailing_list [Boolean])
Booking	(booking_no, *customer_no*, booking_date, payment_method, delivery_method [i.e. mail/collect])
Purchases	(*seat_no, performance_no*, *booking_no)*

Entity Relationship Diagram



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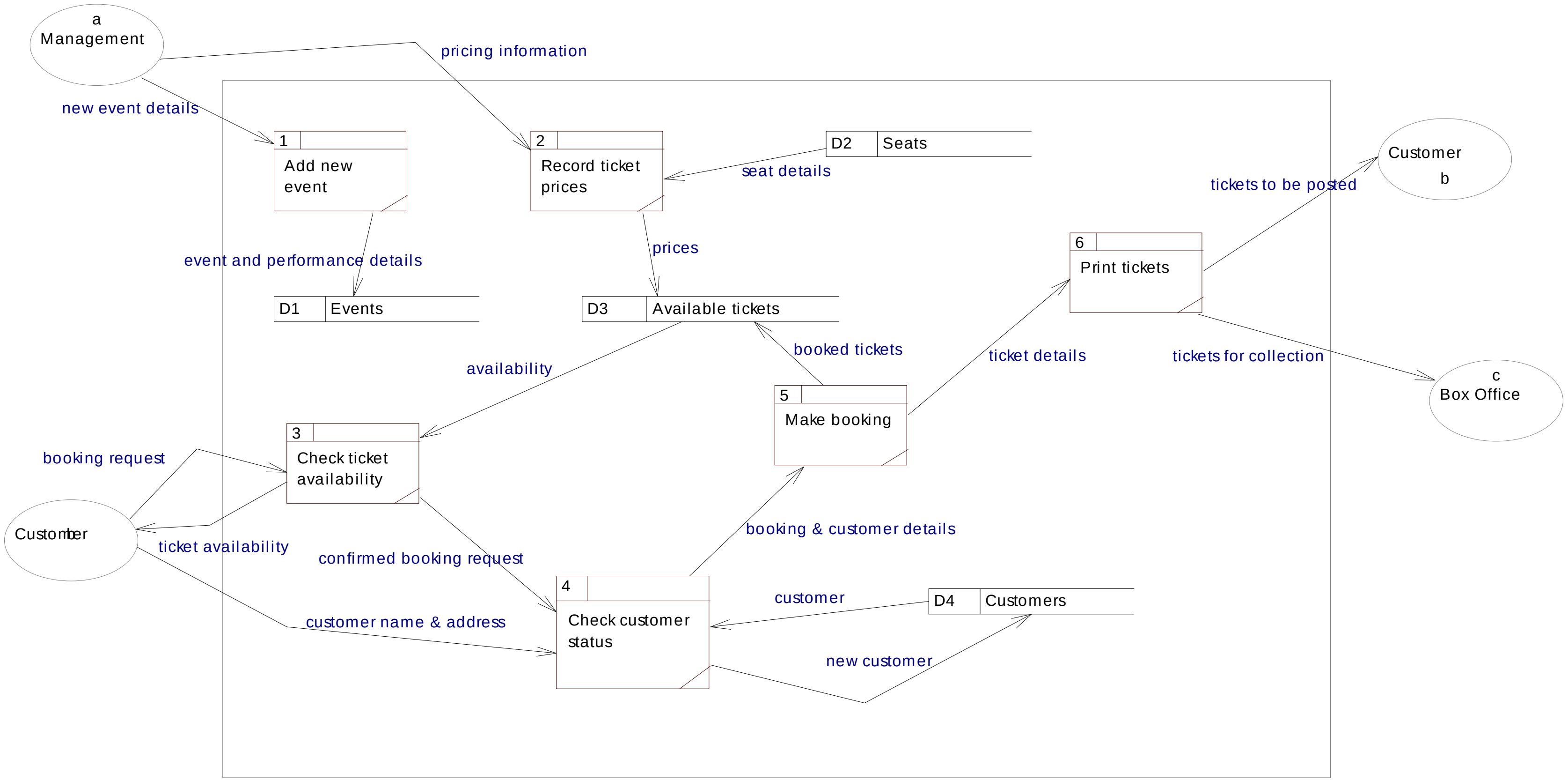
Community Arts Centre (Level 1 Diagram)



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c) i) The third view of the system may be modelled by using an Entity Life History (ELH) *or* a Statechart/State Diagram. For correctly naming one of these: 2 marks

ii) Cross-checking may be done as follows:

- Data Stores on the DFDs correspond to the Entities on the ERD/LDS (there may be more than one entity type to represent a single data store).
- An ELH/Statechart may be drawn for each entity type on the ERD/LDS.
- The attributes of each entity type should be created/modified/deleted by events on the ELH/Statechart.
- Events on the ELH/Statechart correspond to data flows that update data stores on the DFDs.

2 marks for explaining each check + 1 mark for a suitable example = 4x3 = 12 marks

14 marks

Total: 50 marks

Examiners Comments:

1(a): There was generally some poor naming of all DFD components. Some candidates represented processes as on a physical DFD, with the person responsible named. Flows were frequently either not named at all, or labelled with process names (e.g. ‘check availability’). Some data stores were labelled as on a physical DFD, numbered ‘M1’ etc. and with a name such as ‘Customer file’.

Candidates should note that an ‘external entity’ is someone who provides an input, or receives an output, from the system – and not someone who performs an action, such as checking ticket availability.

Many candidates considered ‘mailing list’ as a separate data store. To mail customers with details of forthcoming events, the Arts Centre will require the output of mailing labels consisting of customer names and addresses: i.e. a report compiled from the ‘Customers’ data store.

1(b): Many candidates did not show the membership class, or participation condition, of each relationship, and so could not achieve full marks for relationships on the ERD. No matter what notation is used, both the degree and the membership class can, and should, be indicated. Without this essential information, the data model is incomplete.

Although a good understanding of data modelling was demonstrated by many candidates, some presented tables that contained a considerable degree of redundancy.

1(c): This was the most poorly-answered part of Question 1. Although the majority of candidates correctly identified the third, dynamic, view of the system that is modelled in structured approaches, some then *described* the function of each model instead of explaining how they are cross-checked.

Question 2

a) Describe the 'Hard', 'Soft', 'Hybrid' and 'Prototyping' approaches to systems development.

(16 marks)

b) Propose and justify the approach that you would use for the development of the Community Arts Centre system outlined in question 1.

(9 marks)

Answer Pointers

2(a)

Hard – Those approaches that are relatively fixed, rooted in engineering concepts, focused on technology and prescriptive in terms of stages and procedures, e.g. SSADM, OO, and RUP. Sees organisational life as predictable and discoverable.

Soft - Those that seek to understand the 'softer', less well defined aspects of organisations and their processes. Views the process of SA as one of learning, participation and exploration. May use radically different fact-finding approaches than those used in 'Hard' analysis. Examples include SSM and Ethics.

Hybrid - Those that seek to blend 'Hard' and 'Soft', eg Multiview and thereby benefit from the positive aspects of both approaches.

Prototyping – A term that has many meanings in ISD. Here its major use is in the rapid development of some or all of the systems functionality/features for review by the developers and, more importantly, the clients to then feed back into the development process. Widely used in requirements analysis it has in recent years become more recognized as a full systems development strategy, albeit for smaller more manageable projects. Now formalized and best known as DSDM.

4 marks for each approach described to max' of 4*4 = 16 (marks)
Note: Hybrid - 1 mark only for a simple statement of hybrid being a mix of 2 others and nothing else. Expect to see stages, philosophy, etc, for each.

16 marks

2b - Approach to be adopted
Most likely the Prototyping/DSDM approach will be proposed and justified as follows:

- It's a small system and prototyping is suitable for systems that are smaller, less mission critical and that can be developed quickly
- Can be developed by a small team
- Users can be involved
- It promotes user interaction and therefore acceptance
- Does not need large systems controls or procedures, etc.

Other proposed approaches will be marked on merit of the case made.

9 marks for identifying a candidate approach and justifying it.

9 marks

Total: 25 marks

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Examiners Comments

A popular question that resulted in some very good answers. Prototyping is well understood and was often described in detail. An improvement that many candidates could have made would be to focus more on ‘describing’ the ‘approach’ rather than just defining the terms. Many candidates defined the term but failed to describe what it meant in terms of an approach to systems development.

Question 3

a) Define the term ‘software quality’ and describe THREE techniques or strategies that can be used during systems analysis to assure the quality of a software system.

(15 marks)

b) How do Computer Assisted Software Engineering (CASE) tools assist in assuring software quality?

(10 marks)

Answer Pointers

3(a)

Definition: ‘Quality’: often defined as fitness for purpose; a quality software system is one that will meet the user requirements, with the required levels of reliability, usability etc. This can be assured by means that include:

Measures that can be used:

- **Use of a methodology -** To ensure a standard process; to define the phases through which a systems development project should pass, etc.
- **Communication with users** - Essential to ensure that requirements are correctly determined and modelled; that feedback is received and incorporated on proposed designs, etc**.**
- **Quality check points -** SSADM, for example, provided quality criteria for each product and also formal quality checkpoints when products should be signed off with the customer.
- **Walkthroughs -** Peer review of products, to ensure their quality. Procedure for conduct of walkthrough may be described.
- **Good documentation** – is also acceptable

Up to 3 marks for a suitable definition of quality
Up to 4 marks for three appropriate strategies/techniques identified and described 3*4= 12 marks

15 marks

3(b)

CASE tools:

- Group work
- CASE Assist online management of project and its artifacts
- Help enforce methodology and thereby improve quality
- Standard notation to avoid misunderstanding and improve communication = quality
- Standard documentation - All work is public and open to scrutiny by peers
- Consistency/completeness checks = quality through fewer errors
- Amending/updating achieved more easily
- Can produce/evaluate alternative designs
- Capture of data for re-use
- Clearer communication with user and therefore improved quality

- Can provide data to support the metrics function, thus providing a quantitative measure of quality.

Up to 10 marks for discussion of contribution of CASE tools to QUALITY!

10 marks

Total: 25 marks

Examiners Comments

In part ‘A’ too many candidates considered the whole life cycle and did not restrict their answers to the systems analysis stage and this is unfortunate. Candidates must focus their answer on the particular question and its restrictions. The limit of ‘systems analysis’ in Q3a was quite deliberate in this Systems Analysis paper. The benefits of CASE are well known and presented in detail by most of those attempting this question, but high marks were reserved for those that related the well known advantages of CASE to assuring software quality.

Question 4

The systems models developed in response to question 1 represent a structured approach to systems analysis.

a) Describe the process of systems analysis and the systems models that you would produce if an object oriented (OO) approach had been used.

(10 marks)

b) Support you answer with examples of THREE UML systems analysis diagrams using the scenario outlined in question 1.

(15 marks)

Answer Pointers

4(a)

The main recommended text book outlines the Coad-Yourdon and RUP sequence and it is expected that these will be strongly represented in answers; however any generic process will be acceptable as long as it covers the basic processes and models of SA in OO:

A Coad Yourdon approach	A RUP approach
1. Finding classes and objects	1. Business modelling
2. Identifying structures	2. Requirements(workflow)
3. Identifying subjects (may be reasonable left out by candidates)	3. Analysis and Design
4. Defining attributes	The remaining workflows are omitted as they are not SA!
5. Defining services	

As well as these two approaches that are documented in the main text book more generic approaches will be equally as valid, such as:

1. Project initiation
2. Requirements analysis – modelled in UC diagrams, UC descriptions, sequence diagrams, activity diagrams, etc.
3. Data analysis – modelled in terms of class diagrams
4. Functional/service level analysis – modelled in terms of services, operations, methods, sequence diagrams and activity diagrams.

Marking of this question will be sensitive to the overlap/seamlessness of the Analysis/Design ‘stages’ and their associated models.

Up to 10 marks for a reasonable description of process and high level models of OO SA
(but do not give marks for design/implementation processes and models)

10 marks

4(b)

The most likely UML models will include, use case diagrams, class diagrams and interaction diagrams. These and other SA UML diagrams all acceptable.

Up to 3 marks for each diagram correctly presented to max of 3* 3 = 9 marks
Up to 2 marks for each diagram suitably illustrated by drawing on the Q1 scenario 2*3 = 6 marks

15 marks

Total: 25 marks

Examiners Comments

Not a popular question, however, some very good models were produced in response to this question and high marks frequently awarded. Some candidates lost marks however by failing to describe the ‘process of OO SA’ as was required in the question. Overall, many good answers were forthcoming with Use Case, Class Diagrams and Sequence Diagrams being the most frequently presented models.

Question 5

Explain with examples where appropriate EACH of the following terms:

i)	Joint Applications Development (JAD)	**(5 marks)**
ii)	Systems and subsystems	**(5 marks)**
iii)	Legacy systems	**(5 marks)**
iv)	Critical success factors	**(5 marks)**
v)	Socio-technological analysis	**(5 marks)**

Answer Pointers (from the main text book and http://en.wikipedia)org/wiki/):

i) **Joint Applications Development (JAD)** – a fact-finding technique that brings users into the development process as active participants. The JAD process is based on four basic principles:

1. People who do a job understand it best.
2. Information technology specialists best understand the potential of technology.
3. Information systems and business processes don't exist in isolation -- they transcend any single system or office and affect work in related departments. Those working in these related areas have valuable insight on the role of a system within a larger community.
4. The best information systems are designed when all of these groups work together on a project as equal partners.

Process and principles may be described to include, it's an intensive meeting, of defined length, held in a structured room with a facilitator and scribe.

ii) **Systems and subsystems –** A system is a set of interrelated elements with a set of inputs, outputs and a set of processes (and controls) that convert inputs into outputs. Systems do not work in isolation of each other and depending on the context a system may be part of other systems as a subsystem."A system is composed of regularly interacting or interrelating groups of activities/parts which, when taken together, form a new whole. In most cases this whole has properties which cannot be found in the constituent elements" (wikipedia). Allows for more effective SA.

iii) **Legacy systems –** Older systems that may have originated in the 1960's or 1970's that still provide some fundamental data processing services to an organisation. May be written in 'obsolete' languages with inflexible data structures and processes. Because these were often the original applications developed by businesses they are often the most critical and as such the decision to stay with them or upgrade is a complex one to make. Many modern development environments (e.g. Oracle) provide 'reverse' and' forward' engineering support to update legacy systems.

iv) **Critical success factors –** Set of factors that are regarded as critical to the success of the organisation. Can be at industry, company or department level. They can be broad or specific. A powerful organisational analysis tool applied to IS by Rockart (1979 and 1982. Often used in project selection to identify which proposed project best supports the future success of the company.

v) **Socio-technological analysis -** Refers to the analysis of the interaction between human (and organisation) behaviour and its technical systems and opportunities. It takes a view of SA that is concerned not just with the technology but its social context and implications. It is a very human-centred approach to SA. It involves extending the analysis of processes and systems to include the consideration of the human implications of technological changes.

3 marks for explaining and 2 marks for an example to a max of 5*5 = 25 marks

Total: 25 marks

Examiners Comments

JAD, Legacy and Socio-technical analysis usually well understood, but Systems and Subsystems and Critical Success Factors (CSF) were less well described/explained. Indeed, a common error was to regard systems and subsystems as applications programs and their component, such as MS Office and its programs. CSF was almost unknown but some good guesses were rewarded when possible. In many cases more ‘explanation’ would have been welcome rather than brief notes about the topic.