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Case Study Scenario

Background

*Taps ‘n’ Traps* (TnT) is a family owned business headed up by W C Pann, known to his friends and colleagues as Will. The company was founded in 1927 by Will’s great uncle. Will has been managing director for about 18 months.

TnT produces a wide variety of quality bathroom and kitchen products, using plastic extrusions and mouldings, together with stainless steel pressings and machined items. The production processes range from basic forming operations through to assembly and packing.

A few months ago Will paid for a consultant business analyst to come in and look at TnT’s processes to identify where time and money could be saved, and quality could be improved. It was identified that many of the company’s processes were inefficient, and that having separate IT systems, most of them years old, in the separate departments was causing issues too. The recommendation was to replace all of the company’s aging legacy systems with one integrated system and database. The first area to be looked at, where most gains are expected, is Stores.

Company Structure

The company management team consists of the following:

- **W C Pann**  - Managing Director
- **D Rains**  - Finance Director
- **S Bend**  - Production Director
- **T Seate**  - IT & Admin Manager
- **I M Fluscht**  - Purchasing Manager
- **B Day**  - Stores Manager
The Purchasing Manager and the Stores Manager report to the Production Director, and the IT & Admin Manager reports to the Finance Director.

**Current Situation**

The procedures for the control of stock are performed in the Stores department. Their responsibilities are:

- Goods inwards recording
- Goods outwards recording
- Physical stock movements
- Stock checking

The department is organised as shown below.
Stores Problems and Improvement Opportunities

Accuracy of Computer Stock Records – Auditors have reported that the level of discrepancies between the physical raw material stock and system records is unacceptable. 95% of items sampled were within +10% by volume of the recorded level, and only 20% lay within +1%.

Cost Reduction – The Managing Director wants to reduce the company’s raw material stock levels overall by 5% in value (£250,000) within 12 months.

Stock-Outs – The Financial Director estimates that between £180,000 and £360,000 lost revenue occurs each year from orders cancelled by customers when stock-outs render us unable to meet the target date because of a shortage of one or more key raw materials. The sales department feels that this figure could be greater and cannot evaluate the lost goodwill. In the last financial year there were on average 12 stock-outs per week.

Timeliness of updates – Currently all inward and outward stock movements are recorded on paper forms by the storepersons. These forms are collected twice a day by the internal mail person and taken to the office where they are entered into the system by the receipts or issues clerks. This can lead to up to 17 hours delay between the actual stock movement and it being recorded.

Management Reporting and Controls – The Production Director is not satisfied with the controls exercised, particularly over stock movements, and is unhappy with the quality, quantity and timeliness of management information available.

Stores Project

The Stores Project is the first element in the company’s plans for the replacement of its aging legacy systems. The study confirmed that there is scope for improvement in the stores and purchasing areas, and recommended a new computer system using Personal
Computers on a Local Area Network (LAN) linked to a Central Server.

It is expected that the project will bring the following financial benefits:

- reduced inventory holding freeing up £132,000 capital for investment
- improved turnover by reducing orders lost through stock-outs (increasing profits by up to £36,000 pa)

**Stores Project Business Objectives**

- To enable stock records to be maintained at a level of accuracy of +1% by volume within the next 15 months
- To enable the business to identify low stock situations in sufficient time to arrange deliveries from suppliers
- To facilitate a reduction in stock holding by 5% value within the next 12 months

**Project Constraints**

- This system must interface with the job planning and financial control systems
- The system must be operational within 9 months
- The system should use currently planned hardware, which is to use Personal Computers on a Local Area Network (LAN) linked to a Central Server
Taps ‘n’ Traps Case Study 1

You are part of a systems development team brought in by the MD to look at the stores project.

Read the Case Study Background document on page 55.

Consider the information provided, decide which lifecycle is most appropriate, and recommend a compatible practice for the whole of the stores project.

Provide 2 reasons for your lifecycle recommendation and 1 for your selected practice.

You need to look at the whole of the case study.

5 marks

The sample solution is on the next page
Exercise 1 – Sample Answer

Waterfall lifecycle

- The business is well established and unlikely to change
- The requirements are standard business practice and unlikely to change

Software package practice

- Stock control is a fairly standard system, there are likely to be packages available to match the requirements
- T’n’T does not have developers to build their own solution
- There is a deadline of 9 months to deliver. Buying a package will be quicker than building the system
- The need for interfaces is a concern however; might be some bespoke development required there

Incremental lifecycle

- Stores control functionality could be developed and implemented before the interfaces to other systems
- This gives early benefits

Component-based practice

- A software package could provide the basic stores control functionality with the interfaces being bespoke components
- There are unlikely to be components of the legacy systems that could be reused to shorten the development timescales

Iterative lifecycle

- The project has a time box of 9 months
- Although the overall requirement is clear the detail has not yet been agreed
Prototyping practice

- Early prototypes of the proposed system screens and reports will reduce risk of user non-acceptance
- However there is no in-house IT expertise to develop the prototypes so this would need to be outsourced

Agile/Bespoke practice

- Agile practices for development of the system will be desirable as current staff are not familiar with up-to-date IT systems. Agile would allow them to see working prototypes early and frequently, before going live.
- However there is no in-house IT expertise to develop the system so this would need to be outsourced
Taps ‘n’ Traps Case Study 2

Who in your opinion would make an appropriate sponsor for the Stores Project and why?

Identify 3 other stakeholders (or groups of stakeholders) with an interest in the stores project and recommend an appropriate investigation method you would use to elicit requirements from each. Justify your choice of technique and state what information you would hope to gather from each stakeholder.

You need to look at the whole of the case study.

11 marks

There is a sample solution on the next page
Exercise 2 – Sample Answer

**Sponsor**

Production Director would make a good sponsor, as he has budget and executive authority, and Stores falls within his functional area. Alternatives are MD (but MDs are busy people) and FD (never a bad choice, and audit has an interest here).

**Other Stakeholders**

**Workshop** with office supervisor, stores foreman, a receipts clerk, a goods-in storesperson to confirm requirements for the goods in process. Representatives from other departments linked to the goods in process could also take part in the workshop e.g. lab, buying department.

Use of this technique would help instil a sense of ownership among the frontline personnel, who are in the main unfamiliar with IT applications.

**Prototyping** screens with a goods-in person. This would help to ensure we fully understand the details of the data and procedures for receiving goods.

Prototyping is indicated since visual images will reduce the scope for ambiguity and misunderstanding, especially since very little IT is deployed currently.

**Interview** the Production Director (as Sponsor) to confirm objectives and scope, and to elicit his requirements regarding the controls he requires for stock movements, and also his Management Information requirements.

A one-to-one technique of this kind is appropriate for building a working relationship with this business executive, since he will be the key decision maker.

**Scenario Analysis** with Stores Foreman to elicit information regarding the ‘full story’ of the receipt of goods into the warehouse, the issue of goods from the warehouse and low stock situations.

This technique will help the Foreman picture the proposals, including the use of IT, and we may uncover unusual situations that must be taken into account.

**Note:** Not obvious how questionnaires would be helpful here except as preparation for a workshop or an interview.
Classroom Exercise – BOSH Bank

BOSH bank has recently decided to offer an ATM facility to their customers, and have identified their requirements as follows:

- The ATMs must allow BOSH customers to check balances, withdraw funds, pay cash and cheques in, and print a mini statement of their last 5 transactions. Customers of other banks will be able to check balances and withdraw funds only.
- The ATMs must be available 23 hours a day, 7 days a week. Any downtime must be between 2am and 4am.
- Users will be limited to making 3 withdrawals in a 24 hour period up to a maximum of £200 total.
- Users will be identified by the card number used and this will be authenticated by entering a PIN. Invalid cards will be rejected and 3 incorrect PIN entries will cause the card to be retained.
- At the end of each business day a report will be produced of all successful and unsuccessful transactions.
- The display screen and buttons must comply with Disability Access legislation.

Draw up a table with 3 columns (FR, NFR, and Solution).

Looking at each bullet point in turn, separate functional from non-functional requirements for the IT system required, and classify the non-functional requirements (performance, availability, usability etc.). Identify any solutions mentioned, and try to understand what requirements they might represent.

NB: In UP/UML requirements ‘naming’ is based on the stakeholders (users) point of view – what do they want to do using the system? This approach facilitates the eventual definition of Use Cases.

19 marks

A sample solution is on the next page.
## BOSH Bank – FRs, NFRs & Solutions

<table>
<thead>
<tr>
<th>FR</th>
<th>NFR</th>
<th>Solution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Check Balance</td>
<td>All functionality is available to Bosh customers. * non-Bosh customers can only access these features. (Access)</td>
<td>Printing</td>
<td>Printing is a solution. It may well be a required solution, but perhaps other solutions might be needed too; like email or display for example</td>
</tr>
<tr>
<td>*Withdraw Funds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deposit Cash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deposit Cheques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrieve latest transactions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System can be unavailable for a maximum of 1 hour per day between 02:00 and 04:00 (Availability)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check transaction against withdrawal limits (part of Withdraw Funds)</td>
<td>The system will have a limit of 3 withdrawals within a specified period. The system will have a limit of £200 that may be withdrawn within 24 hour period. (Security)</td>
<td></td>
<td>This is an example of General Business Policy requirements leading to application requirements.</td>
</tr>
<tr>
<td>FR</td>
<td>NFR</td>
<td>Solution</td>
<td>Comments</td>
</tr>
<tr>
<td>----</td>
<td>-----</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Identify User, Authenticate User, Authorise User Access, Suspend User Access.</td>
<td>The system will have a limit of 3 login attempts. (Security or Access)</td>
<td>PIN &amp; Card are solutions</td>
<td>These solutions may well change with new technology (iris scans? DNA?). The basic requirements though will probably remain forever!</td>
</tr>
<tr>
<td>Produce transaction report</td>
<td>End of the business day (Availability)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interface must comply with the Disability Access Legislation (General Legal, leading to NFR Usability)</td>
<td>Screen and buttons are solutions</td>
<td></td>
</tr>
</tbody>
</table>
Produce a Use Case diagram for the Stores System – Goods-in

Look at the Stores Manager requirements below, *Goods In from Suppliers*. Caution: Only the expected IT functionality should be documented.

12 marks

The sample solution is on the next page

Stores Manager Requirements

**Goods In from Suppliers**

1. All deliveries from suppliers are to have a matching purchase order. (The supplier must show a delivery note containing our purchase order number.) We want the Security Guards to be able to check – at the gate – that we have ordered the goods on a purchase order, and that the goods have not already been delivered, before starting to unload the delivery. Deliveries that don’t meet these requirements should be rejected.

2. For each delivery accepted through the gate, the Goods-in guys will unload the merchandise. We must make a record of the delivery and all the delivered items on it.

3. For each delivery item we need to check a marker on its stock record to see if it is to be quarantined for quality testing. Stores management will need a way to set and unset this marker on the system. If an item is to be quarantined, Goods-in are to place it in a separate area of the stores. The delivery amounts of such items are to be held separately from the available stock balance in the system.
4. The laboratory will check the system each morning for the arrival of quarantined goods. The laboratory is to inform the system of their ‘accept’ or ‘reject’ decision for each quarantined item after testing.

   a. *If it is ‘accept’, the system will need to mark the item’s delivery record as accepted and add the quantity to the item’s available balance. Goods-in staff will move the items into the main store.*

   b. *If it is ‘reject’, the system will mark the item’s delivery record as rejected. These goods will have to wait for purchasing to arrange with the supplier to take them away.*

5. Details of all accepted and rejected delivery items are to be sent to the Purchasing Dept. and Stores Management on an end of day report to be available by 8am each day.

General requirements

1. One integrated stores system and database to cover the warehouse and stores office.

2. Integrate the database with purchasing and manufacturing so that up-to-date purchase order and manufacturing order information is always available in the stores office.

3. No paperwork to be used in internal stores or warehouse processes.

4. All updates to the database (e.g. stock movements, stock balance changes) are to be done as soon as the figures are available.

5. All online computer functions must provide a sub 1 second response and be available during warehouse opening hours (08.00 – 18.00 Monday to Saturday).
TnT Stores System - Goods in from Suppliers

- Set Q Marker
- Unset Q Marker
- Retrieve PO Details
- Record Delivery
- Produce Delivered Items Report
- Record Q Item Test Result
- Check for Q Item Arrivals

- Security Guard
- Goods-in
- "Time": 08:00

- Stores Management
- Lab
Fric Ecraser is the chief clerk in the office of *Le Grand Pied* - a staff agency that specialises in hiring out professional wine treaders to the owners of small vineyards in the Bordeaux region of France.

The office procedures that he operates are concerned with allocating resources to wine production projects, recording the resource consumption, and passing on details to the billing department for invoicing customers.

Fric keeps a diary in which he records the availability of the staff of wine treaders. When a client requests treading resources, Fric creates a new project and allocates one or more treaders to the project using a code that is entered onto the project ticket. The codes identify individual treaders, and are taken from the diary. The ticket contains details of the client and expected duration of the project. There is never any shortage of treaders.

Fric puts the treater assignments in the outgoing post to the treaders when he has completed them.

The treaders send the tickets into Fric as they complete a project, at which time he makes any necessary changes to the diary to reflect actual versus planned time. The tickets are then sent to the billing department.

Monsieur Facturier in the billing department calculates the total charge for each client and raises an invoice. The project is not finally closed until the payment has been received by billing and recorded by Fric.

*Review the activity diagram below that models the process outlined above, for standards, completeness and correctness. Look for 10 errors (there may be more).*

10 marks

Check your results with the sample solution on the next page.
Le Grand Pied Activity Diagram Solution

- Activity diagram title Petit Pied is incorrect, should be Grand Pied
- ‘Receive client call’ should not be a send signal node
- ‘Project create’ is not a valid activity name
- The [incomplete] control flow is missing from the decision after ‘Assign resources’ action
- The [complete] control flow is in the wrong direction
- Flow missing between ‘Post assignments to treaders’ and ‘Receive actuals from treaders’
- ‘Update’ is not a valid action name
- Control Flow missing between ‘Update’ action and ‘Send actuals to billing’ send node
- ‘Send actuals to billing’ send node should be an action (not a signal)
- ‘Receive Actuals’ from Chief Clerk should be an action, and is superfluous.
- Control Flow missing from ‘Send actuals to billing’ to ‘Receive Actuals’
- ‘Total charge’ is not a valid activity name
- Control Flow from ‘Raise invoice’ to ‘Despatch invoice’ is in the wrong direction
- ‘Payment record’ is not a valid action name
- ‘Notify chief clerk’ should be an action node. Flow Final is superfluous.
- ‘Receive payment from billing’ should be ‘Receive payment notification from billing’ or perhaps ‘record payment’. Action is superfluous. In any case, these would be actions with a control flow from ‘notify chief clerk’
- Initial node is the wrong symbol to end the process
- Partition name Monsieur Facturier is incorrect, should be Chief Clerk or Fric Ecraser

See correct version of the activity diagram below.
Classroom Exercise – 21st Century DVD Sales

21st Century DVD Sales receive orders for DVDs from customers. The sales department check the customer details on each customer order against a customer file. The customer’s credit rating is also checked. The DVD file is then used to check the DVD details on the customer order. Any problems are resolved with the customer at this stage (by returning the order with a covering note). Once the customer order has been validated it is sent to the purchasing department.

At 3pm every day, purchasing extract the batch of customer orders received from sales and place them on a purchase order, which is then faxed to a specific distributor whose details are obtained from the distributor file. The purchase order is stored in the purchase order file.

In the warehouse, deliveries of DVDs from distributors are received together with an accompanying delivery note, which is checked against the originating purchase order. The validated delivery note is then used with the customer order to assemble an order for the customer. DVDs are despatched to the address of the customer and the invoice is produced and sent; the top copy invoice is stored in the customer invoice file.

Review the Activity Diagram for 21st Century DVD Sales, for standards, completeness and correctness. Look for 10 errors.

10 marks

Check your results with the sample solution on the next page.
21st Century DVD Sales – Activity Diagram

Buying Department

Receive customer order

Check customer details

Customer credit rating checked

Check DVD details ordered

[Problems with order]

Return order with details

Send order to Purchasing

[Problems with order]

Purchasing

Receive order from Sales

Place on purchase order

Add distributor details

Fax to distributor

Purchase order file

4 pm

Warehouse

Receive delivery

Check delivery note vs. purchase order

Match to customer order

Despatch customer order

Create invoice
21st Century DVD Sales Activity Diagram Solution

- ‘Buying Dept.’ partition should be ‘Sales’ or ‘Sales Dept.’
- ‘Customer credit rating checked’ is not a valid action name
- The [problems with order] guard condition is duplicated – the lower one should be [no problems with order]
- Control Flow between ‘Return order with details’ and final node is in wrong direction.
- Final node after ‘Return order with details’ is not correct symbol
- Flow Final is superfluous
- The time event has the wrong time
- ‘Purchase order file’ is not a valid action name
- Control Flow out of ‘Purchase order file’ action is not connected
- ‘Send order to Purchasing’ and ‘Receive Order from Sales’ should be actions. ‘Receive Order from Sales’ is probably superfluous.
- ‘Receive Delivery’ symbol incorrect.
- ‘Assemble Order for Customer’ action is missing
- ‘Store Invoice Copy’ action is missing

See correct version of the activity diagram below.
Classroom Exercise – Hospital Booking System

The following requirements and class model have been identified for a Hospital Booking System - check for standards, completeness and correctness. Look for 10 errors.

A patient may make appointments to seek medical advice on a face-to-face basis with a doctor. Doctors are allocated several appointments to be conducted in one of the clinic sessions held in each of the hospital’s clinics. There is a maximum of 18 appointments per session, though these may be spread across several doctors.

Following consultation and diagnosis, any operations required by a patient are scheduled for a theatre session in one of the hospital’s operating theatres. There may be up to 5 operations in a session. Each operation is performed by one doctor.

10 marks

A sample solution is on the next page.
Hospital Booking Class Diagram Solution

The following errors have been identified on the class diagram:

- Direction arrows missing from all association labels
- Each Clinic Session can only be held in one Clinic; the diagram shows 1.*
- Each Clinic Session may have Appointments conducted by several Doctors; the diagram shows a Clinic Session has one Doctor allocated. This implies that a Clinic Session cannot be set up unless a Doctor is allocated.
- There should be an association between Doctor and Appointment. This would make the association between Doctor and Clinic Session redundant.
- ‘Doctors’ is not a valid class name as it is plural.
- Spaces in class names violates recognised naming conventions.
- The unlabelled association between Doctor and Patient has no multiplicity and is redundant. The relationship only exists through Appointment or Operation.
- The model indicates that a Clinic Session cannot exist unless there is at least one Appointment for it. The correct multiplicity would be 0..18.
- The model indicates that a Theatre Session cannot exist unless there is at least one operation scheduled. The correct multiplicity would be 0..5.
- ‘operate’ is not a valid class name.
- The model indicates that a Doctor requires an operation, and a Patient performs an operation; this is the wrong way round.
- Multiplicity missing Patient – Appointment. Association label not shown.

Corrected version below:
Classroom Exercise – Expenses Claim

On my working assignments around the country I often have to pay bills – for instance hotel bills, restaurant bills, taxi fares, and train fares. I always get a receipt once I have paid, and I store receipts in a pocket at the back of my briefcase until the next time I am in the office.

Once in the office, I get an expense claim form from the cupboard. The form has useful information about amounts claimable printed on the back. Using the receipts from my briefcase, I complete the claim form with one line per claimable expense (once I have filled in the claim I regard it as completed), take a copy of the form, which I file in my desk drawer, and send the original to accounts together with all the relevant receipts. When I have sent it to accounts, I mark the claim as sent.

Accounts will occasionally send me the form back with messages attached about some mistake I have made. If this happens, I mark the claim to show that it is under review. In this case I will correct the form, take another copy to replace the old one in my drawer, and send the revised form to accounts. When I send it to accounts I again regard the claim as sent.

Eventually, accounts will send me a cheque for each claim made (when I get the cheque from accounts I mark the claim as paid), and a payment slip, which I reconcile with the claim copy from my drawer. Then, if I have any doubts over the amount paid to me I mark the claim to show that it is being queried and telephone accounts, and once or twice I have managed to get another cheque out of them this way! Once I am satisfied that the amount paid is correct, I mark the claim as reconciled. I put the cheques in my jacket pocket ready for my next trip to the bank.

At the bank I fill in a deposit slip with my account details, attach the cheques and hand them over. I put the stamped deposit slip stub in my wallet (for later reconciliation with my next bank statement – not part of expense claim system). Once the money is paid into the bank I mark the claim to show it is now banked. I get rid of the claim after 5 years.

8 marks

A sample solution is on the next page.
Review the state machine diagram for the class Claim below against the description above and standards, and identify 8 anomalies.
Expenses System State Machine Diagram

Solution

The following points are the significant discrepancies, see the solution below:

- The wrong symbol is used for the start state
- The wrong symbol is used for the end state
- Initial transition has no event label
- State ‘Completing’ is not an appropriate state name
- Event ‘send’ is not an appropriate event name
- The transition “accounts query received” is in the wrong direction
- The transition “claim corrected” is in the wrong direction
- Event ‘pay’ is not an appropriate event name
- The transition from “Queried” to “Banked” should be between “Queried” and “Reconciled”
- The time event ‘5 months elapsed’ should be ‘5 years’
- Use of a guard condition is incorrect; after is a keyword, requiring arguments (parameters)
Classroom Exercise – Gordon’s Confectionery

Gordon’s Confectionery is a small company who specialise in producing sweets and candies using only natural products. Customers will order via the internet and a sales order will only be despatched when all items are available (i.e. there will be no part deliveries). All new sales orders received each day will be held on the system as unallocated orders. Each night available stock will be allocated to any orders that have an outstanding requirement for stock. Where the order has been fully allocated with stock, it will be converted to ‘allocated’. Similarly, where stock is partially available, it will be converted to part allocated. It will remain part allocated until the remaining stock becomes available, at which time it will become allocated.

An allocated order will be converted to ‘picked’ when all the stock has been picked for it. All picked orders will be despatched the next working morning. Each evening all despatched orders will have invoices printed and they will become invoiced. Once complete payment has been received, the invoiced orders will be changed to completed and held on the system for 2 years before deletion and removal from the system.

Customers can cancel their order at any time up until it has been picked. If a customer cancels their order, it will become cancelled. Cancelled orders will be held on the system for 12 months before they are deleted and removed from the system.

*Review the state machine diagram for the Order class below against the above description and standards, and identify 8 anomalies.*

8 marks

A sample solution is on the next page.
Gordon’s Confectionery State Machine Diagram

Solution

The following points are the significant anomalies, see the solution below:

- ‘receive’ is not a valid event label.
- No end state, whereas the scenario implies that there should be one.
- ‘Order deleted’ is not an event supported in the scenario; should be ‘order cancelled’.
- “Order cancelled” state should just be “Cancelled”.
- Transition between “Order Cancelled” and “Deleted” state should be 12 months elapsed, not 2 months.
- Transition between “Completed” and “Deleted” state should be 2 years elapsed, not 2 months.
- Transition between “Completed” and “Deleted” is in wrong direction.
- “Deleted” is not a state supported in the scenario.
- Transition from “Allocated” to “Part Allocated” is in the wrong direction.
- “Invoice printed” and “stock despatched” transitions are the wrong way around, and would be better documented as time events.
- Stock that is ‘allocated’ may be ‘cancelled’, but no transition is shown for this.
- ‘complete payment received’ is an event and so should not have brackets.
Classroom Exercise – Acme Vehicles
Record Daily Mileage

As each driver returns to the depot at the *Acme Vehicle Co.* they hand in their completed journey log for input to the computer system by the Transport Clerk. This data is used to alert the fleet manager of vehicles that are due or overdue for servicing.

**Use Case: Record Daily Mileage**

*Pre-condition: Primary Actor is authorised for this function*

<table>
<thead>
<tr>
<th>Step</th>
<th>Transport Clerk</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select ‘Record Daily Mileage’</td>
<td>Shows ‘Record Daily Mileage’ screen</td>
</tr>
<tr>
<td>2</td>
<td>Keys in vehicle ID (VIN)</td>
<td>Validates vehicle VIN. Retrieves and displays Vehicle record, incl. Start Mileage. Prompts for Journey Date and End Mileage.</td>
</tr>
<tr>
<td>3</td>
<td>Enters Journey Date and End Mileage</td>
<td>Validates Journey Date and End Mileage. Prompts for confirmation.</td>
</tr>
<tr>
<td>4</td>
<td>Confirms data</td>
<td>Calculates mileage for the journey, updates vehicle record and the daily mileage audit trail. Displays transaction confirmation.</td>
</tr>
<tr>
<td>5</td>
<td>OK</td>
<td>Ends Use Case.</td>
</tr>
</tbody>
</table>
**Post-condition:** Mileage recorded for a given vehicle on a specific date

**Alternative Flows:**

A1. VIN has an invalid format (valid format is 2 alphas / 3 numerics / 2 alphas / 10 numerics)

A2. Vehicle is not found

A3. Journey Date is invalid. A valid date is in format dd/mm/yy and must be a working day

A4. End Mileage is invalid. End Mileage must be greater than Start Mileage.

Based on information presented above construct a Test Case for the Main Use Case Flow only, using the format of the table in the notes.

10 marks

A sample answer is on the next page
# Acme Vehicles - Record Daily Mileage Solution

<table>
<thead>
<tr>
<th>UC Step</th>
<th>Test Condition “test the …”</th>
<th>Input Data</th>
<th>Base Data</th>
<th>Expected Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Selection of ‘Record Daily Mileage’ option</td>
<td>Select ‘Record daily Mileage’</td>
<td>n/a</td>
<td>‘Record daily Mileage’ screen is displayed</td>
</tr>
<tr>
<td>2</td>
<td>Input of a valid VIN which identifies the target vehicle</td>
<td>A valid VIN (format is 2 alphas/3 numerics/2 alphas/10 numerics)</td>
<td>Target vehicle with its VIN</td>
<td>System accepts the input and displays the vehicle record.</td>
</tr>
<tr>
<td>3</td>
<td>Input of a valid Journey Date</td>
<td>A valid date (dd/mm/yy) which is a working day date.</td>
<td>Working day dates.</td>
<td>Input is accepted.</td>
</tr>
<tr>
<td>3</td>
<td>Input of a valid End Mileage</td>
<td>A mileage which is greater than the Start Mileage for the target vehicle.</td>
<td>Start Mileage for the target vehicle.</td>
<td>Input is accepted.</td>
</tr>
<tr>
<td>4</td>
<td>Confirmation of data entry</td>
<td>Confirmation signal</td>
<td>n/a</td>
<td>The Start Mileage on the vehicle’s record has been updated to the End Mileage figure and an audit record has been written. ‘Transaction confirmed’ screen is displayed.</td>
</tr>
<tr>
<td>5</td>
<td>Ok selection</td>
<td>OK Selected</td>
<td>n/a</td>
<td>Return to the previous function</td>
</tr>
</tbody>
</table>
Classroom Exercise – BOSH Bank SLA

BOSH bank has recently decided to offer an ATM facility to their customers, and has identified the following requirements:

- The ATMs must allow BOSH customers to check balances, withdraw funds, pay cash and cheques in, and print a mini statement of their last 5 transactions. Customers of other banks will be able to check balances and withdraw funds only
- The ATMs must be available 23 hours a day, 7 days a week. The down time must be between 2am and 4am
- The ATM system must have fraud prevention measures. Users will be limited to 3 withdrawals in a 24 hour period up to a maximum of £200 total
- The ATM system must have access control measures. Users will be identified by the card number used and this will be authenticated by entering a PIN. Invalid cards will be rejected and 3 incorrect PIN entries will cause the card to be retained
- At the end of each business day a report will be produced of all successful and unsuccessful transactions
- The display screen and buttons must comply with Disability Access legislation

Using the requirements above, identify three services provided by the new system that should have SLAs applied to them. For each distinct example provide a brief description of the service provided and the associated service levels required. A sample answer is on the next page.

6 marks
BOSH Bank SLA

Service
The ATMs will allow BOSH customers to check balances, withdraw funds, pay cash and cheques in, and print a mini statement of their last 5 transactions.

Service levels
The ATMs must be available at least 23 hours a day, 7 days a week. Any down time must be between 2am and 4am.

Service
The ATMs will allow customers of other banks to check balances and withdraw funds.

Service levels
The ATMs must be available at least 23 hours a day, 7 days a week. Any down time must be between 2am and 4am.

Service
A daily report will be produced of all successful and unsuccessful transactions.

Service levels
The report will be printed at 18.00 each day. (Note that 18.00 is assumed to be the end of the working day – this would need investigation)
Taps ‘n’ Traps Case Study 4

Identify 2 services and 2 x associated service level for each, for the stores system from the Taps ‘n’ Traps Stores Manager’s requirements.

Look at the Stores Manager requirements on page 15.

6 marks

There is a sample solution on the next page.
Exercise 4

Service
The Stores System will provide the business with accurate, up to date information on the current raw material stock holding, purchase orders and manufacturing orders.

Service Level
- The system will be available 08.00-18.00 Monday to Saturday
- The system will provide a sub 1 second response time for enquiries and adjustments

Service
The system will report all accepted and rejected deliveries to Purchasing Dept.

Service level
- Report will show all deliveries recorded
- Report will be produced by 8am each working day
Consider the information provided in the Case Study and recommend an appropriate handover approach for the stores project.

Look at the Stores Manager requirements on page 15.

Analyse factors such as risk, cost, time and resources against the available handover options, in order to make your recommendation.

Provide 2 reasons for your recommended approach.

Give one reason each for rejecting the other three handover approaches that you have not recommended.

6 marks

There is a sample solution on the next page.
Exercise 5

Big Bang
This approach is compatible with the Waterfall lifecycle and either a Package or Bespoke solution (see exercise 1).

- **For:** All the required functionality is delivered in on go within the timescales given which will quickly enable a reduction in clerical costs and improved stock accuracy, leading to fewer stock outs and cancelled orders. This is also the most cost-effective approach.

- **Against:** Bigger disruption and TnT have to wait until everything is finished before any benefits are achieved.

Phased
This approach is compatible with the Iterative or Incremental lifecycles, and Agile or Component-based practices (see exercise 1).

- **For:** It may be possible to (1) split the functionality, for example to provide goods in processing but not the facility to record the issue of goods (however, see below), or (2) deliver a solution to stock control in phase one and interfaces to other systems in later phases. In the case of option 2, this would deliver some benefits earlier and lead to less disruption.

- **Against:** Option 1 would mean either building interfaces to the existing stock recording system, which might prove difficult, or entering data onto the new and old systems until the implementation was complete. Option 2 would not give interfaces to other systems until later, though this would be no worse than the current situation.

Pilot approach is rejected as TnT has only one warehouse, with a small number of employees who would be using the system, and one central database, and so it is not suitable for piloting.

Parallel running approach is rejected because continuing with the recording of deliveries and issues on the old system while also entering data into the new stores system would slow the process down considerably. This would also be the most expensive approach. As the current process is not fit for purpose there seems to be little benefit in choosing this approach.
Practice Paper

BUSINESS SYSTEMS DEVELOPMENT
CERTIFICATE IN SYSTEMS DEVELOPMENT ESSENTIALS

QA SDE Sample Examination Paper

DO NOT OPEN THIS EXAMINATION PAPER UNTIL YOU ARE TOLD TO

Time allowed: 1 hour

- You will have fifteen (15) minutes of reading time before the examination starts. Do not write, mark, highlight or underline anything during this time.

- This is an open-book examination. This means you can refer to written material in addition to the examination paper itself.

- Attempt ALL questions.

- Start each question on a new page.

- You must answer the questions in English using only blue or black ink; pencil or highlighter must not be used.

- Answers that are simply copied or quoted from reference material will receive no credit.

- If you think a question is unclear or incorrect, write the reason why you believe the question to be faulty and your interpretation.

- If the paper appears incomplete or a question is illegible, please bring this to the attention of the invigilator immediately.

- At the end of the examination, you must hand in all written work, PLUS the Examination paper. (Cross through any written work you do not wish to have marked).

The total number of marks achievable is 50 – The pass mark is 50%

CANDIDATE NAME:___________________________
Burley Library

Burley is a quiet village in the middle of the New Forest. The New Forest District Council provides funding for new books.

A new Branch Librarian has recently been appointed, Ms Evelyn Watts, who has decided that she would like to computerise all of the front office procedures associated with running the library. The district council have agreed to fund the purchase of a computer and the acquisition of suitable software. This is on the understanding that the requirements must be approved by the council’s Library Sub-committee and that the system will be made available across their other 5 libraries eventually too, once funding has been approved for a network and more computers. This will allow library members to use any branch and the branches will be able to see each other’s stock.

Ms Watts has asked her nephew, Archie, to help her conduct the analysis for the new system as part of his A-level computing course work.

Archie has started drawing a class diagram (attached) to document the data required to support the requirements of the new system. He has noted that they have more than one copy of some books, all with the same attributes (such as title, author, ISBN number) so they need to be able to identify which copy is associated with which loan.

Ms Watts and Archie have met with the council’s administrator of Library Services, and together they have come up with the following initial list of requirements for the new IT system, which should be available, as a minimum, during normal library opening hours:

1. Would-be members are required to register with a branch. Only people who live within the council’s jurisdiction may join the library. This will be checked by means of the postcode entered on the new member screen. They will have to bring proof of identity and address when joining.

2. All members are to have a unique membership code, which will be allocated by the system upon joining.

3. The Branch Librarian may need to amend member details from time to time.

4. Members may borrow loan items and return them during branch opening hours. The number of loans is limited to a maximum of 8 loans per member at any one time. Each loan is for one loan item.
5. Fines will be levied for late return of loan items. These fines will be based on a daily rate that increases up to a maximum value of the replacement cost.

6. Members may pay fines as they return items or pay by post. The system must record the payment.

7. At the end of each month, the system must produce a report on members who have not borrowed anything in the previous 12 months so they can be contacted about their membership.

8. The system will prevent members who have outstanding fines from borrowing anything else until they have paid their fines.

9. Any member who loses more than two items, or who is fined two maximum fines, in a year will have their membership cancelled. These members must be reported on monthly. Only the Branch Librarian can cancel a person’s membership.

10. Members are allowed to reserve books. A librarian will notify the member by email or post when the reserved book is available for collection.
**Question 1**

The Domain Class diagram, shown at Annex A, was created by Archie to support the requirements of the Library system. Review the diagram against the scenario and the UML standards for Class diagrams, and identify 10 errors, omissions or inconsistencies.

(10 marks)

**Question 2**

a). Review the requirements listed in the scenario. One Use Case describing requirements for the new system will be ‘Cancel Membership’. Identify 6 more Use Cases (functional requirements) relevant to the new library front-office system. You are not required to draw a Use Case Diagram. (6 Marks).

b). Identify from the same scenario list, 3 non-functional system requirements, and assign them to a recognised NFR category. (6 Marks).

(12 marks)

**Question 3**

Archie has decided that, as the system might eventually be used in all six of the council’s libraries, it would be a good idea to confirm the requirements with all of the branch librarians. State which 2 investigation techniques (2 marks) you would recommend for doing this, and give 3 reasons for each technique to show why it is appropriate (6 Marks).

(8 marks)

**Question 4**

Attached at Annex B is a Use Case Description for ‘Cancel Membership’. Draw up a Test Case for this Use Case, based on the Main Flow only, using an approved format. 2 Marks are available for each Test Condition appropriately documented.

(12 marks)

**Question 5**

a) Specify which recognised handover approach you would recommend for the implementation of the library system in the six
libraries (2 marks), giving three reasons why you have selected this approach (3 marks).

b) State why you would not recommend each of the other 3 recognised approaches, giving one reason per approach (3 marks) (8 marks)

Exam Paper Total Marks = 50 Marks
Annex A
Annex B

Use Case: ‘Cancel Membership’

Pre-condition: Primary Actor is authorised for the function

<table>
<thead>
<tr>
<th>Step</th>
<th>Librarian</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Selects ‘Cancel Membership’ option</td>
<td>Displays ‘Cancel Membership’ screen. Prompts for Member ID.</td>
</tr>
<tr>
<td>2</td>
<td>Enters Membership ID</td>
<td>Retrieves Member details. Prompts for confirmation of correct Member.</td>
</tr>
<tr>
<td>3</td>
<td>Confirms correct Member</td>
<td>Displays Member details with membership cancellation option.</td>
</tr>
<tr>
<td>4</td>
<td>Selects ‘Cancel Membership’ option</td>
<td>Prompts for confirmation of cancellation</td>
</tr>
<tr>
<td>5</td>
<td>Confirms ‘Cancel’</td>
<td>Updates membership record to ‘cancelled’. Confirms transaction</td>
</tr>
<tr>
<td>6</td>
<td>OK</td>
<td>Ends Use Case</td>
</tr>
</tbody>
</table>

Post-conditions: Membership cancelled for selected Member

Alternatives:
A1: Membership ID not found
A2: Librarian quits
A3: Wrong Member
A4: Cancellation not confirmed
END OF PAPER

The marking scheme with sample answers is on the next page.
Sample Paper Marking Scheme

N.B. Remember in the exam you are asked to critique a model and identify the anomalies, not to correct the problem. In the answers below, corrections are provided to aid your understanding.

Question 1 Sample Answer – Total 10 Marks

Award 1 mark for each correctly identified error as listed below, up to a maximum of 10 marks. If the candidate finds any additional plausible errors then these may be allowed.

- There are no arrows on the associations to show which way they are to be read
- Books is an invalid class name, should be singular noun
- Multiplicity between Books and Reservation is wrong, a Reservation is for 1 Book, a book may have 0 to many Reservations
- A member may have 0 to 8 loans at a time, therefore multiplicity 1..8 at the Loan end of the ‘responsible for’ association is incorrect and should be 0..*
- Replacement cost should be an attribute of class Book not a separate class
- The association between Reservation and LoanItem is incorrect. The association should be between Reservation and Loan (i.e. Reservation becomes Loan).
- The multiplicity at the Member end of the association ‘pays’ is incorrect; a fine is paid by 1 and only 1 member
- Daily rate is not a class, it is a value used in the fine calculation. It is not clear from the scenario where this value will be held
- There is no name on the association between Fine and DailyRate
- Multiplicity 1..0 at the Fine end of the unnamed association between Fine and DailyRate is incorrect
- Multiplicity is missing at the DailyRate end of the association between Fine and DailyRate
Question 2 Sample Answer – Total 12 Marks

2a. 1 mark for each valid Use Case identified, similar to those below, up to a maximum of 6 (6 marks max):

The system will provide functions to:

- Register New Member
  - Validate Member’s Postcode is within range
  - Allocate unique Membership code
- Amend Member details
- Check out Loan Item
  - Prevent borrowing for a Member with outstanding fines
  - Prevent borrowing of more than the maximum of 8 items at any one time
- Check in Loan Item
- Calculate Fines
- Record Fine Payment
- Produce a report of members who have not borrowed anything in the last 12 months
- (Cancel Membership – no mark for this as it is given in the question)
- Produce report of Members who have had 2 maximum Fines, or have lost more than 2 Loan Items, in the last 12 month period
- Reserve a Book
- Notify Reserving Member

*Items in italics are parts of Use Cases and do not attract marks.*

2b. One mark for each valid Non-functional requirement plus one mark for a plausible NFR category. (6 marks max.):

The system will operate within the following constraints:

- the ‘lapsed members’ report is to be available at the end of each month (Availability)
• the ‘two maximum fines’ report is to be available at the end of each month (Availability)
• the ‘Cancel Membership’ functionality is to be restricted for use by the Branch Librarian only (Access)
• system to be available during ‘normal library opening hours’, as a minimum (Availability).
Question 3 Sample Answer – Total 8 Marks

Recommended techniques would include:

- Workshop(s) *(1 mark)*, with a representative from each library, as this would:
  - Ensure the librarians felt involvement/ownership
  - Allow consensus/agreement between the librarians on functional requirements
  - Encourage the librarians to be creative in the specification of the system *(3 marks)*

- Prototyping *(1 mark)* as this would:
  - Reduce the risk of requirements being missed. As this is a greenfield site there is a significant danger of this.
  - Give the librarians a chance to become familiar with the look and feel of the system.
  - Help to verify the usability of the system in the libraries. *(3 marks)*

These are examples only, and marks may be awarded for suitable alternatives.
**Question 4 Sample Answer – 12 Marks**

A suitable answer would be something like the following:

<table>
<thead>
<tr>
<th>UC Step</th>
<th>Test Condition “test the …”</th>
<th>Input Data</th>
<th>Base Data</th>
<th>Expected Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Selection of “Cancel Membership”</td>
<td>Option Selection</td>
<td>n/a</td>
<td>Cancel Membership screen is displayed</td>
</tr>
<tr>
<td>2</td>
<td>Input of a valid Membership ID</td>
<td>Valid Membership ID</td>
<td>Membership ID and Member details exist.</td>
<td>Member details are displayed. Prompt for ‘correct Member’ confirmation.</td>
</tr>
<tr>
<td>3</td>
<td>Selection of “Correct Member” confirmation</td>
<td>Option selection</td>
<td>n/a</td>
<td>Member details are displayed, with cancellation option.</td>
</tr>
<tr>
<td>4</td>
<td>Selection of ‘Cancel Membership’ option</td>
<td>Option selection</td>
<td>n/a</td>
<td>Prompt for cancellation confirmation</td>
</tr>
<tr>
<td>5</td>
<td>Confirmation of ‘Cancel Membership’</td>
<td>Option selection</td>
<td>n/a</td>
<td>Membership record is updated to ‘cancelled’. Transaction confirmation message is displayed.</td>
</tr>
<tr>
<td>6</td>
<td>Selection of OK</td>
<td>Option selection</td>
<td>n/a</td>
<td>Return to previous function</td>
</tr>
</tbody>
</table>
Award Marks:

2 marks are available for each row as shown above or similar in character. Deduct ½ Mark for each significant error in any row; min marks for any one row = 0 Marks
Question 5 Sample Answer – 8 Marks

The following is a sample answer. Other answers may be possible, and if properly justified, these should be marked on their merits.

a). The recommended approach would be Pilot (2 marks).

Implementing a fully functioning pilot system at Burley library then rolling it out to each of the other libraries in a sequence has the following example justifications:

- Reduces the risk of all libraries working on the new system simultaneously, as the librarians may well have little experience of using IT.
- Only the staff at the library undergoing conversion are disrupted, not all staff.
- The pilot will prove that all the functionality required has been thought of, it is working and meets the librarians’ needs.

Award 1 mark for each valid reason, up to 3 marks max.

b). Award 1 mark each for the following rejection reasons (or suitable alternatives):

- **Big Bang** – too high risk across all libraries, when there is so little IT experience amongst the librarians. Would seem to be unnecessary risk, since there are no pressing deadlines.
- **Phased** – It’s not easy to see how the new library system’s IT functionality could be conveniently modularised, but there could of course be phasing in the sense of the roll-out to each library in turn, once funding has been approved.
- **Parallel** – a period of parallel processing in one library would mean extra resources needed there and it isn’t obvious what the parallel period would set out to prove in this case.