SOFTWARE DEVELOPMENT

Units 3 & 4 – Written examination

(TSSM's 2016 trial exam updated for the current study design)

SOLUTIONS

SECTION A: Multiple-choice questions (1 mark each)

Question 1

Answer: B

Explanation:
A data dictionary lists details of variables, including their name, type, size, scope and a description of their purpose.

Question 2

Answer: C

Explanation:
Documentation is an activity undertaken during the development stage of the problem-solving methodology.

Question 3

Answer: D

Explanation:
Whilst data structures are used when programming, they are not a processing feature. Processing features of programming languages include instructions, procedures, methods, functions and control structures.

Question 4

Answer: B

Explanation:
Marketability is a factor that influences the design of a solution – it is not a non-functional requirement.

Question 5

Answer: A

Explanation:
Options C and D are impossible for both diagrams, and both a context diagram and a DFD can contain multiple external entities so option B is also incorrect.

Question 6

Answer: D

Explanation:
Iteration, sequence and selection are all examples of control structures.

Question 7

Answer: A

Explanation:
Although options B and C are desirable, the most important from a customer's point of view is security of transactions. They wouldn't mind either way about the cost to the company involved in developing the site.

Question 8

Answer: C

Explanation:
This sequence will loop through twice, as after one iteration both x and y are equal to 2.

Question 9

Answer: B

Explanation:
Repeat….until is a form of iteration.

Question 10

Answer: D

Explanation:
An instruction is a single line of code that can modify the contents of a variable.

Question 11

Answer: A

Explanation:
A stick figure in a UCD represents an actor. A process is an ellipse, the system boundary is a rectangle and an external entity is used in DFDs, not UCDs.

Question 12

Answer: C

Explanation:
A type check would validate that the input is reasonable, in this case that it is an integer.

Question 13

Answer: B

Explanation:
Validation involves checking the reasonableness of data being input into a system.

Question 14

Answer: A

Explanation:
Naming conventions are not visible to users of a solution, only programmers, so it would be of no use to end users.

Question 15

Answer: D

Explanation:
User's details have been given to a third party organisation without the client's consent, which is against the law according to The Privacy Act 1988

Question 16

Answer: B

Explanation:
An array is a data structure accessed via an 'index', as demonstrated in the algorithm.

Question 17

Answer: D

Explanation:
A variable that can be set to true or false is most likely a Boolean.

Question 18

Answer: C

Explanation:
An algorithm can show logic errors only. It has not been coded yet, therefore it cannot show syntax or run-time errors.

Question 19

Answer: A

Explanation:
Characteristics of data that has integrity are accuracy, timeliness, reasonableness, authenticity and correctness. Affordability is a factor that influences the design of a solution.

Question 20

Answer: B

Explanation:
A virtual private network has greater security for transmission and hence is usually adopted by banks for secure transmission of data on the web.

Section B – Short answer

Question 1

A method is a way of changing the behaviour of an object, or something that it can do, whereas an event often happens when a program is running that is triggered by a user's interaction.

2 marks

Question 2

An associative array is an abstract data type composed of a collection of pairs, such that each possible key appears just once in the collection. A common example of an associative array is a library system, where the pair includes the book and the patron who has it currently checked out.

Associative arrays have a number of operations such as add, reassign, remove or lookup.

2 marks

Question 3

a.

Variable name	Data type/structure
i	*integer*
A[]	*array*
subList	*integer*

3 marks

b. The algorithm divides the input list into two parts: the sublist of items already sorted, which is built up from left to right at the front of the list (at lines 1 and 2 - Which is items up to the variable i), and the sublist of items remaining to be sorted that occupy the rest of the list.
The iteration at lines 3-7 check the remaining subList for the smallest value.
At lines 8-10 the smallest value is swapped with the first value of the subList and this is now considered to be sorted.
This reduces the size of the unsorted list by 1 each iteration, and continues until all items have been sorted.

3 marks

c. **Selection**: Selection looks at testing a condition then executing one of a number of actions, depending on the result. This can be seen in the IF statement from lines 4-6.
Iteration: Iteration works by repeating a number of tasks a set number of times or until a certain condition has been met. In the algorithm, line 3 is an example of iteration.

4 marks

Question 4

Accidental threats to data and information are done without malicious intent, for example a user accidently deleting a file they meant to keep. Deliberate threats are done with intent, like a disgruntled employee stealing or deleting important files. Events-based threats include natural disasters, for example a server room flooding after a big storm.

3 marks

Question 5

Testing involves first selecting appropriate functions to check, then selecting a range of test data that would check all boundaries of the solution and calculating expected results. The tests are run on the program using the functions and the set of test data is entered to get actual results. These are compared these with the results that were expected and documented. If the expected results and actual results differ, the procedures will need to be re-looked at.

3 marks

Section C – Case Study

Question 1

   a. Milestone: A milestone is an event used to mark specific points along a project timeline that indicates a significant stage of a project. A milestone is represented as a diamond on a Gantt chart and has zero duration.
Critical path: A critical path is the sequence of project network activities which add up to the longest overall duration. This determines the shortest time possible to complete the project.

<div align="right">2 marks</div>

   b. Tasks in a project are interdependent, meaning they must be completed in a particular order. The commencement of some tasks depends directly on the task that is completed before and this is called a 'dependency'.

<div align="right">2 marks</div>

Question 2

   a. An organisational goal is a statement that describes what an organisation wishes to achieve in the future. Organisational objectives support organisational goals by providing shorter term targets with measurable results.

<div align="right">2 marks</div>

   b. In the case study, one of the organisational goals of TMTA is to reduce the cost of becoming qualified. The updated solution will allow users to enter in results and communicate without necessarily needing to send staff out for site visits. This will reduce the need for a number of staff and save TMTA money.

<div align="right">2 marks</div>

Question 3

There are three tasks involved in analysing an information system:

Determine the solution requirements: Solution requirements include the functional requirements (what the solution is required to do) and the non-functional requirements (the attributes of the solution).

Identify the solution constraints: Constraints are anything that can affect the nature of the solution, such as cost, speed of processing, legal requirements, etc.

Determine the scope of the solution: The scope looks at what the solution can and cannot do.

3 marks

Question 4

Fast IT Solutions will need to interview Terry. Terry is the one asking them to create the solution and will therefore have the most in depth knowledge. An interview will allow for them to ask a wide range of questions and gain immediate feedback, giving a thorough overview of what is required of the solutions.

They can also use observation at work sites. They can watch the tasks that apprentices carry out and the current method of recording whether they are competent or not. This will allow them to look at ways of integrating this feedback into the new solution.

4 marks

Question 5

Validation is the process of checking the reasonableness of data that is input into an information system. Existence checking looks at whether or not a user has entered anything at all. This must come before a type check as a type check looks at whether or not the data entered is the correct data type (string, character, integer, etc) and for this to occur the data must exist. Finally a range check looks at whether the data entered falls within pre-set boundaries. A range check won't work unless the data has been validated to be the correct type as a string could not fall between a range of 1-10, for example.

4 marks

Question 6

When storing data, Terry must ensure that all data is kept secure and up to date.

When communicating data, Terry must ensure that it is only sent to other organisations if the clients have given their consent.

4 marks

Question 7

```
BEGIN

    total ← length(skillsFile[])
    found ← FALSE
    count ← 0

    REPEAT
        IF skillsFile[count] = skillToFind THEN
            found ← TRUE
        END IF

        count ← count + 1

    UNTIL count = total OR found = TRUE

    IF found = TRUE THEN
        DISPLAY "Skill added to student's list"
    ELSE
        DISPLAY "Skill is not required"
    END IF
END
```

8 marks

Question 8

User friendliness: User friendliness relates to the intuitiveness of a solution. In this case, there will be many tradespeople that will be required to interact with the solution and it must be easy for them to use.

Robustness: Robustness is how well a solution responds to poor or unexpected user input. As stated, there will be a range of users with varying ability. The solution will need to be able to handle unexpected input such as non-existent skills being entered.

4 marks

Question 9

A method of ensuring data is secure during transmission is encryption. Encryption will scramble data into cipher text so that it is unreadable to anyone but the intended recipient, as only they will be able to unscramble it back into plaintext. May be add the concept of keys to decipher the data.

2 marks

Question 10

    a. A software requirements specification (SRS) sets out and documents the analysis of an information problem. This includes functional and non-functional requirements, the scope and the constraints upon a solution. A SRS often forms the basis of a legal contract as it is agreed upon by both developer and client, and if this was done correctly at the start then it would have been clear what is expected to be included in the solution.

2 marks

    b. The list must be sorted.

1 mark

    c. A binary search is a "divide and conquer algorithm". It is highly efficient as it will split a list in two and discard the unwanted half each pass, finding its required value with few passes. It does this by setting a midpoint (mid) which is halfway between the end of the list (high) and the start of the list (low). If compares this to the required value (valueToFind). If it is higher than the required value, the upper part of the list is discarded by setting "high" to "mid", then recalculating "mid". If it is lower, "low" becomes "mid" and them "mid" is recalculated. This continues until "mid" is the same as "valueToFind" or the list is empty.
It is far more efficient than a linear search as it halves a list every time, whereas a linear search will check each value in a list individually.

5 marks

Question 11

Students are one type of user. They will require access to resources, instructions on tasks to be completed, details on employment opportunities and deadlines.

Tradespeople are another type of user. They will require the system to output past results for a student and a list of the tasks that each student has completed.

4 marks

Question 12

Terry is incorrect in his assumption that not including internal documentation will decrease costs, as although it may be quicker to code initially, debugging it will take longer as programmers will have more trouble understanding the purpose of the code, and this will also add to maintenance time. With the additional time taken for developing and maintaining the solution, Terry will need to pay programmers for their additional time, therefore increasing, not decreasing the costs.

4 marks

Question 13

Backing up involves copying files from a workstation to a secondary storage device, such as an external portable hard drive. Archiving also involves copying files to a secondary storage device, however the files are then removed from their initial location in order to free up space. As Terry is removing the original files, he is archiving.

3 marks

3 marks

Question 14

Has the new system reduced organisational costs?

This criterion would measure efficiency, and a method for checking this is to calculate the total costs from previous years and divide this by the number of students to get a cost per student. Do the same since the new solution was introduced and compare the costs to see if the solution has reduced costs.

Are more graduates finding employment?

This criterion would measure effectiveness, which can be measured by checking the percentage of graduates that have found employment in their industry within three months of graduating before the solution was introduced and compare these numbers to those after the solution has been introduced.

4 marks

Total 100 marks