Solutions

1 (a)(i) Sort the list of numbers (L) in descending order

(a)(ii) FOR Count2 <- 1 TO (MAX – 1);

(a)(iii) L[Count2] <- L[Count2 + 1];

(a)(iv) L[Count2 + 1] <- Temp;

(b) 63

(c) Set SwapMade to have a value of False before the inner loop starts;

If a swap is made then set SwapMade to True;

Change the outer loop so that it keeps on repeating until SwapMade equals False;

**Note:** if neither of the first two mark points have been awarded 1 mark should be awarded for the idea of creating a flag / Boolean variable

**Alternative answer**

Set NoMoreSwaps to have a value of True before the inner loop starts;

If a swap is made then set NoMoreSwaps to False;

Change the outer loop so that it keeps on repeating until NoMoreSwaps equals True;

**Note:** if neither of the first two mark points have been awarded 1 mark should be awarded for the idea of creating a flag / Boolean variable

**Alternative answer**

Set NoOfSwaps to have a value of 0 before the inner loop starts;

If a swap is made then increment NoMoreSwaps;

Change the outer loop so that it keeps on repeating until NoMoreSwaps equals 0;

**Note:** if neither of the first two mark points have been awarded 1 mark should be awarded for the idea of creating a counter variable

**A.** any sensible identifier

**A.** no identifier specified

**A.** alternative sensible data type

**A.** pseudo-code answers

2

(a) What are the Morse codes for the letters N and Y? **[2]**

**Y = . . (dot dot)**

**N = - . (dash dot) (1 mark each)**

(b) Draw a diagram of the binary tree which shows clearly the position of the letters D, C and B in the tree. **[3]**

A picture containing object, antenna

Description automatically generated

(c) Explain why this binary tree representation is not the most suitable data structure for performing English to Morse code conversion. Describe a better alternative, and explain how the Morse code of a letter could be found. **[5]**

**Why not the most suitable ? ( 1 mark)**

**require a tedious tree traversal algorithm to find the morse code equivalent of a letter. Some kind of total tree traversal method would be needed.**

**Alternative data structures: (3 marks for any one structure)**

**(i) Linked list: not recommended as it does not improve efficiency at all.**

**(ii) 2 one-dimensional arrays: one containing the letters while the other containing the Morse code for each letter.**

**- linear search of “letter” array to locate the index from which the equivalent morse codes can be found.**

* **binary search instead . (better efficiency)**

**(iii) store the Morse codes in a 1D array indexed by the letters of the array if possible, and by codes A = 1, B = 2, C = 3, …Z= 26. The morse code can be retrieved directly from its index value ( or from its index value after calculation).**

| **A** | **. -** |
| --- | --- |
| **B** | **- . . .** |
| **C** | **- . - .** |
| **D** | **- . .** |
|  |  |

A screenshot of a social media post

Description automatically generated

4 A close up of text on a screen

Description automatically generated

5 **All marks AO2 (analyse)**

**1 mark** for any one correctly drawn relationship **OR**

**2 marks** for three relationships drawn correctly

**Max 1** if more than three relationships drawn and any are incorrect

**A.** a many:many relationship drawn between EventType and Fixture as this is modelled by a linking relation (EventAtFixture)

A close up of text on a black background

Description automatically generated

(b) **All marks AO2 (analyse)**

There is no data type for the primary key/AthleteID // The primary key/AthleteID needs a data type;

The data type is specified before the fieldname // fieldname should precede the data type // PRIMARY KEY is specified before the fieldname; **A.** an example of a specific field and data type which are the wrong way around

There is a semi-colon missing at the end;

**Max 2**

**(c)**

**All marks AO1 (understanding)**

\*Minimise data duplication // no unnecessary repeated data; **A.** reduce for minimise **R.** eliminate

\*Eliminate data redundancy; **A.** reduce/minimise for eliminate

Eliminate data inconsistency // improve consistency // avoid inconsistency problems;

Eliminate update anomalies; **A.** example in context **A.** updates only need to be made in one place

Eliminate insertion anomalies; **A.** example in context

Eliminate deletion anomalies; **A.** example in context

**NE.** easier to update/insert/delete without concrete example or good explanation

**NE.** fewer errors when updating/inserting/deleting without concrete example or good explanation

**NE.** saving space/memory

**NE.** easier/faster to query

**Note: Only award one of the two marks with \*. ie a response cannot get two marks for discussion of only duplication and redundancy**

**(d)**

**3 marks for AO2 (analyse) and 2 marks for AO3 (programming)**

Mark Scheme

**AO2 (analyse) – 3 marks:**

**1 mark** for correctly analysing the data model and identifying the tables that data needs to be extracted from (Athlete, EventEntry, Fixture) and the fields that need to be extracted (Surname, Forename, DateOfBirth), and including these and no other tables or fields in the query

**1 mark** for correctly identifying how the data in the required tables should be combined to produce the desired result (the linking conditions - Athlete.AthleteID = EventEntry.AthleteID and EventEntry.FixtureID = Fixture.FixtureID)

**1 mark** for identifying the correct condition to use within the model for the FixtureDate field (FixtureDate = "17/09/2018") and for using the correct logical operators between all of the conditions (if a linking condition is also used)

**Note:** The AO2 marks for analysing the data model should be awarded regardless of whether correct SQL syntax is used or not as they are for data modelling, not syntactically correct SQL programming

**AO3 (programming) – 2 marks:**

**1 mark** for fully correct SQL in two of the four clauses (SELECT, FROM, WHERE, ORDER BY)

**OR**

**2 marks** for fully correct SQL in all four clauses (SELECT, FROM, WHERE, ORDER BY)

**Note:** For an SQL clause to be counted as “fully correct”, the syntax of the clause must be correct and the relevant AO2 decisions must also have been taken for the clause. eg the SELECT clause must have the correct fields in it only

Example Solutions

**Example 1**

SELECT Surname, Forename, DateOfBirth

FROM Athlete, EventEntry, Fixture

WHERE FixtureDate = "17/09/2018"

AND Athlete.AthleteID = EventEntry.AthleteID

AND EventEntry.FixtureID = Fixture.FixtureID

ORDER BY Surname

**Example 2**

SELECT Surname, Forename, DateOfBirth

FROM Athlete INNER JOIN EventEntry ON Athlete.AthleteID =

EventEntry.AthleteID INNER JOIN Fixture ON

EventEntry.FixtureID = Fixture.FixtureID

WHERE FixtureDate = "17/09/2018"

ORDER BY Surname

**Overall Max 4 if solution does not work fully**

Additional Guidance

**AO2 marks:**

Mark(s) can be awarded for the correct logical conditions even if the required tables are not identified as being used by the query

Allow the inclusion of the unnecessary table EventAtFixture for AO2 and AO3 marks but only if it is linked to the other tables with a correct condition ie EventAtFixture.FixtureID = Fixture.FixtureID or alternatively EventAtFixture.FixtureID = EventEntry.FixtureID or both

Allow omission of delimiters around date for AO2 marks only.

**AO3 marks:**

**A. table names before fieldnames separated by a full stop.**

**A.** use of Alias/AS command eg FROM Athlete AS A then use of A as the table name but note that command Alias is not required eg FROM Athlete A.

**A.** INNER JOIN written as one word ie INNERJOIN.

**A.** ORDER BY written as one word ie ORDERBY.

**A.** ASC at end of ORDER BY clause but **R.** ASCENDING

**A. insertion of spaces into fieldnames.**

**A.** use of " # or ' as delimiters around date – **Note:** delimiters are required for AO3 correct code but not for AO2 mark for date condition

**A. date parts given in any order so long as they are separated by /**

**A.** 18 instead of 2018 in year

**I. unnecessary brackets.**

**DPT** for unnecessary punctuation – allow one semicolon at the very end of the statement, but not at the end of each clause.

**DPT for fieldname before table name.**

**Refer responses using nested SQL queries to team leaders.**

6(a) Set of rules/agreed signals/agreed codes (for data exchange between systems)

(b) (i) Telnet/SSH/SSH2/RSH (HTTP/HTTPS if not used in (iii) or (iv))

(ii) POP/IMAP/POPn/IMAPn where n is a number from 1 – 4 (Telnet if not used in (i). (SMTP wong answer. User-level email clients typically use SMTP only for **sending** messages to a mail server for relaying)

(iii) HTTP

(iv) HTTPS

Need full names of protocols.

**6(c)(i)** **A** the protocol to be used // secure hyper-text transfer protocol // hyper-text transfer

protocol secure;

**NE.** hyper-text transfer protocol

**B** the FQDN // fully qualified domain name; **A.** the address of (Nanyang JC) web server

**C** the path and resource to be returned; **A.** path / pathname / file path

**(ii)** sg// .sg;

(d) (i) To take a required FQDN and to return an IP address; To link/map a FQDN to an IP address **R. URL**

(ii) The (local) computer already has a copy of the needed IP address (in a hosts file);

The (local) computer has a cache of recent DNS queries / answered DNS queries;

1. previously visited site / refreshing a page;

The URL typed in already contains an IP address;

The URL refers to a local resource, e.g., a file on the local computer // localhost ;

**NE.** intranet

(e) (i) application (layer);

**A.** fourth layer;

(ii) To fetch different parts of the web page that also include a URL;

To fetch a needed image / video / javascript / css / resource;

**R.** transmission error

**R. network busy**

(iii) Port that is temporarily assigned / only exists for duration of a connection;

Port number automatically allocated // assigned from the TCP/IP stack;

**A**. a port number in range 1024 - 65535

**7 (a)** 1 ; 4 ; 3 ;

**(b)(i)** Data that can (uniquely) identify a living person;

**(b)(ii)**

*Linked to context:* **(MAX 2)**

Data could be used to track location (and activities) of a person; Data links a person to a specific location and car at a (specific) time; Number plates might not be recognised accurately (suggesting, incorrectly, a car was at a particular location);

*General points:* **(MAX 1)**