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SUBJECT GRADE EXAMINER NAME CLASS	Information Technology Theory	DATE	November 2014
	11	MARKS	150
	Mrs Kench	MODERATOR	Mr Gill
		DURATION	2 ½ Hours

COGNITIVE LEVELS			
LOW ORDER	33 %	MIDDLE ORDER	38 %
		HIGH ORDER	39 %

INSTRUCTIONS COMMENT	
TEACHER'S SIGNATURE PARENT'S SIGNATURE	

QUESTION 1**TERMINOLOGY****10 MARKS**

Answer and write only the letter (A–D) next to the question number (1.1–1.10) in your ANSWER BOOK.

- 1.1 D gateway. (1)
- 1.2 A Attenuation (1)
- 1.3 D both conditions will never be true at the same time. (1)
- 1.4 A ASMP (1)
- 1.5 B ensures that data has been transferred from one place to another correctly. (1)
- 1.6 C CSMA/CD (1)
- 1.7 D fraudulent action of collecting personal information about an individual in order to assume his/her identity. (1)
- 1.8 C is translates source code line by line (1)
- 1.9 B a check bit in a group of bits. (1)
- 1.10 D (ii) and (iii) (1)

QUESTION 2**HARDWARE AND SOFTWARE****43 MARKS**

2.1

- 2.1.1 The volunteer observes that the CPU contains registers. Briefly explain the function of registers. (2)

Store current instruction and data.

- 2.1.2 Explain why instructions loaded in cache memory are processed faster by the CPU than instructions stored in RAM. (2)

Any TWO reasons why instructions in cache are processed faster than instruction in memory ✓✓:

- Cache is higher quality/faster type of memory/cache is static RAM compared to dynamic RAM
- Cache is positioned on the CPU/Cache closer to CPU and thus fetches instructions faster
- Data in RAM needs to be transferred via busses to the CPU before it can be processed/Fetching of instructions from cache is not restricted by slow speed of the motherboard

- 2.1.3 The basic process of how a CPU operates consists of four stages, namely fetch, decode, execute and store. What is the purpose of the FETCH stage? (2)

Copy instruction from RAM to registers

- 2.1.4 What is the physical connection between the CPU and the north bridge called? (1)

Any ONE of :

- System bus
- Internal bus
- FSB (front-side-bus)

- 2.1.5 Different slots, such as AGP and PCI Express, are found on a motherboard.

- (a) What is the purpose of the AGP slot? (1)

To plug in 3D graphics cards

- (b) To which bridge (north or south) is an AGP slot connected? (1)

North bridge

- (c) Someone told the volunteer that the PCI Express slots are on-board and not hot-pluggable.

(i) What does on-board mean? (1)

The hardware is physically part of the motherboard

(ii) What does it mean when a device is NOT hot-pluggable? (1)

The computer has to be switched off and opened up to be able to plug in devices✓.

2.1.6 All computer systems contain RAM and ROM.

(a) State TWO major differences between RAM and ROM. (2)

Any TWO differences between RAM and ROM ✓✓:

- ROM has smaller capacity than RAM
- ROM takes physically less space than RAM
- ROM slower than RAM/slower type of memory
- ROM content stable even if computer is switched off – RAM loses its content (volatile)
- ROM read only – RAM read and write access possible
- ROM is mounted on motherboard – RAM is mounted on modules slotted into the motherboard

(b) Explain the purpose of ROM. (1)

Any ONE of ✓):

- ROM contains instructions to be executed when the computer is switched on
- The software controlling non-computerised devices such as microwave ovens, etc. is stored in ROM-chips

2.2 Large quantities of data related to all the athletes need to be saved on hard drives (HDD).

2.2.1 Which ONE disk controller, EIDE or SATA, will you recommend for connecting high-performance hard drives? (1)

SATA

2.2.2 Explain TWO aspects that influence the access time of an HDD. (2)

Latency is the time during which the read/write head of the hard drive is idle while the platter spins to the correct sector.✓

Seek time is the time taken by the read/write head to find the correct track ✓

2.2.3 Disk caching will improve performance in terms of the storage and retrieval of data. Explain what disk caching is. (2)

Disk caching is when part of the RAM✓ is used to store parts of the application that must be saved on the hard drive✓ so that faster access to the software is possible.

2.3 A cellphone company offered to supply smartphones to the organisers at the different centres.

2.3.1 Name ONE operating system developed exclusively for use on smartphones. (1)

Symbian

- Android
- Windows 8 Phone
- Apple iPhone/iOS 6/iOS 7
- Blackberry OS

2.3.2 Describe THREE responsibilities of the operating system of a computer system regarding the management of memory. (3)

- Each process in RAM has enough memory space
- No process tries to use memory space allocated to another process
- All the different types of memory in the computer are used efficiently
- Used memory is released when it is no longer in use

- All programs that are running are in RAM so that the CPU can fetch their instructions and execute them

2.3.3 Some of the organisers complained that some websites show less content when displayed on the smartphones, compared to displaying them on regular PCs.

Give a possible reason for the seemingly missing content. (2)

Any TWO reasons for missing content of website on smartphone✓✓:

- Smartphones have much lower screen resolutions in comparison to a standard computer
- Some websites don't make mobile-browser-specific versions of the website available
- Depending on web page content it can take substantially longer to load a page on a mobile browser – and the images may seem to be missing

2.4 Data stored about the athletes must be protected against loss or damage. Although backups will be made regularly, data can still be lost due to unexpected power failures.

2.4.1 Suggest how the loss of data due to unexpected power failures can be prevented.

(2)

Make use of a UPS to supply power to the PC✓ for a limited time period so that the user can save/backup data being used and safely shut down✓

2.4.2 Give TWO reasons, other than power failures, for the loss of or damage to data. For each reason, suggest a measure that can be adopted to prevent the loss or damage of data. (4)

Any TWO reasons for data loss and the correct measure(s) of prevention: ✓✓✓✓

(1 mark - reason for loss/damage, 1 mark for prevention)

- damaged equipment/computer crash – maintain computer equipment; keep computer free from dust
- hacking/cracking – install firewalls
- theft – protect data via passwords and restricted access
- deletion of data by user - protect data via passwords and restricted access/set user rights to prevent editing documents
- deletion of data by viruses – have up to date anti-virus software

2.4.3 Give TWO reasons why the local hard drive of a PC will not be suitable for backup purposes. (2)

Any TWO reasons why local hard drive not suitable for backup✓✓:

- Difficult to remove and keep in a safe place somewhere else.
- Space can be a problem for backup of large volumes of data
- Many copies on different local hard drives can become a problem to manage
- Local hard drive may be susceptible to virus attacks – destroying the files
- Computer crash – can cause read/write heads to damage hard drive platters while spinning

2.5 The organisers created a help desk to support the volunteers at the different centres. The following conversation took place between one of the volunteers and the help desk:

Help desk:	What antivirus program is installed on your computer?
Volunteer:	Firefox.
Help desk:	That is not an antivirus program.
Volunteer:	Oh, sorry ... Internet Explorer.

2.5.1 Neither Firefox nor Internet Explorer is an antivirus software application. Identify the category of software that both of these applications belong to. (1)

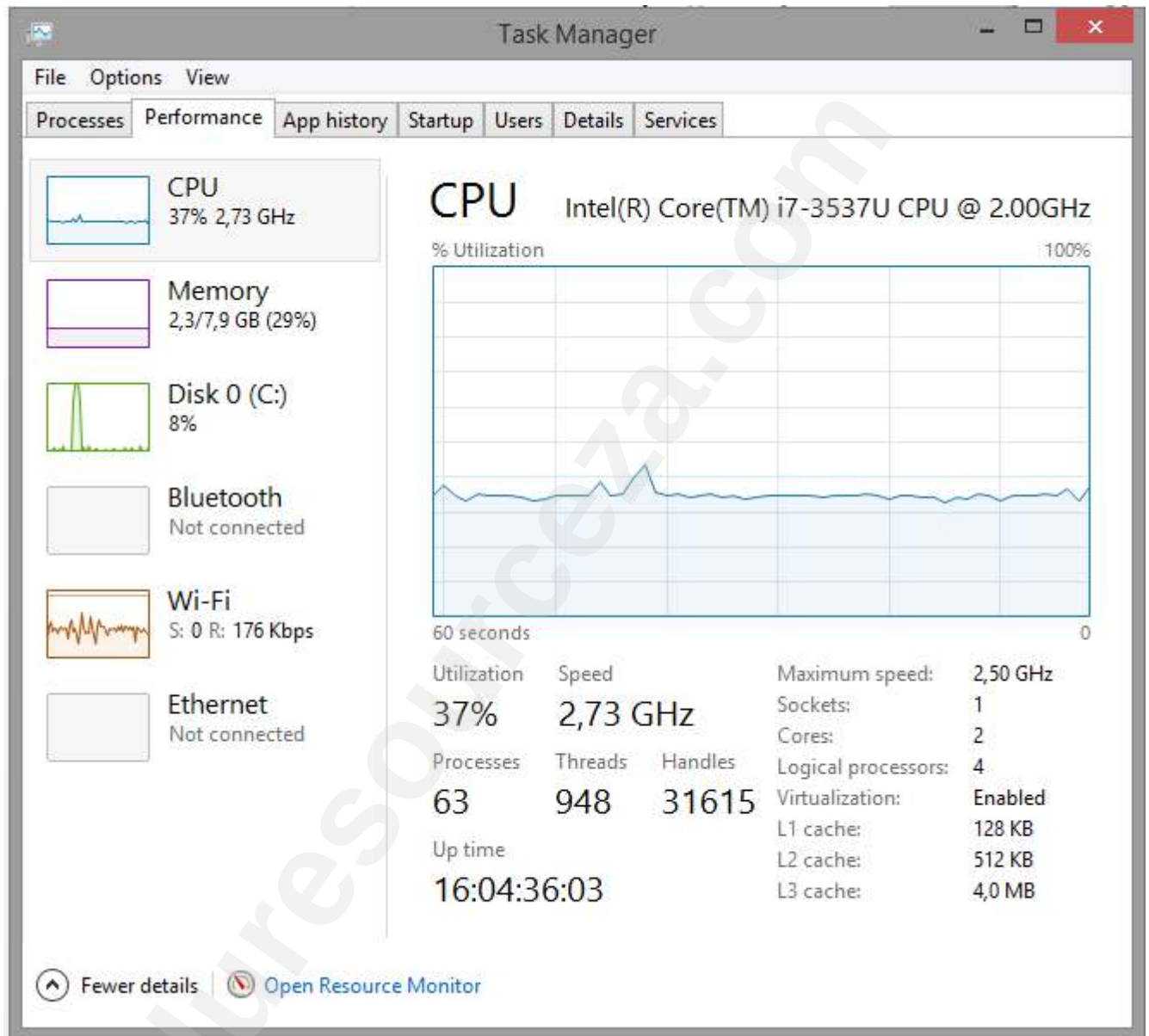
Internet browsers or System software

2.5.2 Apart from protecting a computer against viruses, state TWO other forms or useful protection that antivirus software normally offers. (2)

Any TWO useful protections from anti-virus software✓✓

- Scanning of e-mail
- Prevent malware/backdoor software
- Prevent adware/spyware
- If file is infected by a virus – quarantine/sandbox mode the file

2.6 The organisers looked at the performance of one the computers in the newly installed network using the Windows Task Manager.



2.6.1 What is the total amount of cache available on this computer? (2)

4736✓MB✓

2.6.2 How do you know the CPU is a hyperthreaded dual core? (2)

There are 2 cores✓ but 4 logical✓

2.6.3 A computer system can use several different processing techniques. Explain the following processing techniques:

(a) Multitasking (2)

Multitasking is when a computer appears to✓ run multiple programs at the same time✓ by splitting the CPU time between the tasks. ✓

(b) Multiprocessing (2)

Multiprocessing is when there is more than one CPU or core✓ and the operating system needs to divide the tasks between the processors. ✓

- 2.6.4 The diagram states that the maximum speed of the CPU is 2.5GHz but the actual speed is 2.73GHz, explain why this speed is more than the maximum speed. (2)

Overclocking✓ – the CPU can change its speed. ✓

- 2.6.5 The disk graph has a single sharp spike. What do you think occurred for this spike to happen? (2)

Save or load✓ from disk✓

QUESTION 3 NETWORKING

50 MARKS

- 3.1 The centres in each city that will host athletic events have a set of computers connected in a LAN, using a switch.

- 3.1.1 From the organisers' perspective, list THREE advantages of having a local network at each of the centres. (3)

Any THREE advantages of local network from organisers viewpoint: ✓✓✓

Centralisation of data

- Sharing of hardware – reduce operating cost
- Improved security
- More efficient use of resources

- 3.1.2 What type of topology is most likely to be used with these networks? (1)

Star✓

- 3.1.3 In the context of computing, explain the difference between a router and a switch.

A *switch* is used for a specific type of network✓ while a *router* is able to join and convert data packets from one type of network to another. ✓

(2)

Six client computers and one server computer to be networked were installed at the head office. An administrative office has been set up in each city where athletics meetings will take place to collate and send results to the head office.

- 3.2 The Ethernet network communication standard is used at the head office.

- 3.2.1 Name TWO types of cabling is used by Ethernet? (2)

UTP ✓ and fibre✓

- 3.2.2 Ethernet uses a protocol to transmit and receive data.

- (a) What is a protocol? (2)

Protocol is a set of rules✓ that define the way that data will be transferred between two devices. ✓

- (b) Name the protocol used by Ethernet. (1)

TCP/IP

- 3.3 The organisers have been offered either an ADSL or a 3G Internet connection to connect the various administrative offices to the Internet.

- 3.3.1 Which do you think would be better ADSL or 3G? Give TWO factors you need to consider in your answer. (3)

Choose either with reasons✓ 3G – wireless✓, but cost, ✓ or ADSL – need to be wired but cost is cheaper.

3.4 Each athlete competing in the half-marathon event will receive an RFID tag.

3.4.1 Briefly explain how an RFID tag functions. (2)

How does RFID tags function:

The tag sends radio signals✓ to a receiver which identifies the wearer of the tag/user✓.

3.4.2 State TWO advantages of using RFID tags from the event manager's perspective. (2)

Any TWO advantages of using RFID tags in the marathon: ✓✓

- Check progress of athletes during the race
- Every athlete can be identified at certain points to ensure that they completed the whole race and did not take shortcuts along the road.
- Most convenient way to track athletes

3.4.3 Marshals on duty at strategic points along the road agreed to use their smartphones as a means of communicating with fellow marshals along the road during the event.

(a) Explain why Wi-Fi will NOT be a suitable connection type. (1)

Any ONE reason why Wi-Fi not suitable ✓

- Wi-Fi has a short/limit range
- Wi-Fi hotspots may not be available along the entire route

(b) Suggest TWO ways in which the marshals can communicate using their smartphones with minimal or no additional costs. (2)

Any TWO of ✓✓

- SMS
- Facebook
- mXit
- BBM
- whatsapp

3.5 The network at the head office uses the client-server model.

3.5.1 Name ONE other type of network model. (1)

Peer-to-peer✓

3.5.2 State TWO advantages of the client-server model using this scenario. (2)

Any TWO advantages of client-server model ✓✓:

- More sophisticated security
- Better sharing of resources
- Better performance
- More computers can be connected to the network

The organisers requested that an online website portal be developed where athletes can view their results and maintain their personal details.

3.6 The website uses cookies.

3.6.1 Why is cookie not considered as a virus? (2)

Text file ✓and not executable. ✓

3.6.2 Explain how cookies can be used in Web 2.0 web sites. (2)

Cookie records browsing history ✓to customise user's web experience. ✓

3.7 One of the organiser's computers is sending spam e-mails to all the athletes without his permission.

3.7.1 Explain what a spam e-mail is. (1)

Spam is bulk distributed e-mails that usually advertise something that you don't want or need. ✓

3.7.2 What can be done to stop a computer from sending spam? (1)

Prevent computer from sending spam: Any ONE of the following:

- Make use of anti-spam software/content filtering software
- Regularly scan your computer for any malicious software with anti-spyware software
- Scan and remove the virus sending spam using an anti-virus program.
- Do not accept invitations from unknown Internet sources asking for account details as this may hijack your e-mail account for sending out spam.

3.7.3 Suggest TWO ways in which the receipt of spam can be limited. (2)

Any TWO ways to limit the receipt of spam ✓✓:

- Contact your ISP/network administrator and ask them to put filters on the e-mail you receive
- Do not supply your e-mail address to anybody
- Install spam filters/content filtering software

3.8 The organisers want to ensure that athlete's details are kept secure when they sign into their profiles on the website. This can be done by using encryption.

3.8.1 Define encryption. (2)

Encryption is a method where text or data is scrambled ✓ to an unreadable format. ✓

3.8.2 Do you think a 40 bit encryption key is sufficient? Explain your answer. (2)

No it is too small ✓ and is easy to crack using brute force. ✓

QUESTION 4

SOCIAL IMPLICATIONS

10 MARKS

4.1 The financial manager notices that a large sum of money has been taken from the bank. When the bank was contacted, it seems that the money was taken by someone who knew the password and bank account details. The financial manager was the only person who knew the banking account number and password.

4.1.1 Identify and explain three ways in which someone could have obtained the banking information. (6)

Shoulder surfing ✓ - observe the victim ✓
 Dumpster diving ✓ - retrieve personal info from trash ✓
 Role playing ✓ - use helpdesks etc. to pretend to be useful ✓
 Phishing - get victim to divert to a site which will gather info
 Surf organisation website to gain info about employer

4.2 The organisation wants to track each athlete whilst they run any of the registered races. The RFID tag will be secured in each athlete's shoe which uniquely identifies the athlete. When an athlete runs a race, their exact speed and location will be superimposed on a map of the race and updated in real time. The athlete's whereabouts will be displayed in real time on the organisation's web site.

4.2.1 Do you think it is a violation of the athlete's rights to provide this information? Give TWO reasons for your answer. (4)

Yes - location of athlete should not be available. ✓✓ Athlete may not want the details of their speed to be known. ✓✓

QUESTION 5

PROGRAMING

MARKS

The data on athletes is managed using custom software designed for the athletics meetings and is stored in a database. Many of the athletes have participated in the ultra-marathon event more than once. Each time an athlete has completed the ultra-marathon they are awarded a medal. The ultra-marathon event has taken place since 2000.

5.1 The tblAthletes table below is currently used to store athletes' details and event results.

Field Name	Data Type	Description
AthleteNumber	Number	Unique number assigned to each athlete
AthleteName	Text	Name of athlete
DateOfBirth	Text	Athlete's date of birth
Club	Text	The club the athlete is a member of
PhoneNumber	Number	Athlete's phone number
Event	Text	Event the athlete entered for
Result	Text	Numerical result for the event
NumberOfMedals	Number	Number of times the athlete won a medal

5.1.1 Which field in this table is the most suitable primary key? (1)

AthleteNumber ✓

5.1.2 Identify TWO fields in the table with poorly chosen data types and recommend more appropriate data types. Write down only the name of the field and the suggested data type. (4)

Any TWO FIELDS ✓✓: two marks for correct type✓✓

(Mark allocation: 1 mark for database field AND correct data type)

- PhoneNumber – Text
- DateOfBirth – Date/Time
- Result - Number

5.1.3 Name and describe two checks that can be performed on the NumberOfMedals field. (4)

Range check ✓ – to determine the number of medals is in range✓

Type check✓ – check it is a numeric field✓

Presence check – user must fill in field

5.1.4 What measure can be taken to ensure that the field containing the athlete's name will never be left blank? (1)

Set to not null in definition

5.2 The programmers used✓ exception handling in their programming code.

5.2.1 What is exception handling? (1)

Code to alter flow of program particularly for errors✓

5.2.2 A programmer has written the following code:

```
try {
    runMethodA();
    runMethodB();
} catch (SomeKindOfException e){
    Display "Error message"
}
```

(a) Explain the order that the code will be executed if an exception of type SomeKindOfException is generated in runMethodA(). (2)

After runMethodA, ✓ control will jump to the catch✓

- (b) Explain What will happen if runMethodB() generates an exception different to SomeKindOfException? (2)

Run time error✓ as there is no catch for exception✓

5.2.3 During a test of the software that was developed, the program stopped working with the following error message:

'execution halted – an overflow error occurred'

- (a) Explain why overflow errors normally occur. (1)

Too many bits to be stored in a limited no of bits✓

- (b) Besides exception handling, what other programming structure can be used to prevent a runtime error such as this one from occurring. (1)

If statement✓

5.3 An algorithm needs to be developed as part of the management software that the programmers are busy developing.

5.3.1 The following algorithm has been designed to find and display a specific athlete but it contains a few logical errors:

```

Line 1   Input the name of the athlete
2       found ← false
3       counter ← index of first element in the array
4       While found = false
5         If input name = array[counter]
6           found ← true
7           counter ← counter + 1
8         endif
9       found ← false
10      End repeat loop
11      If found = true
12        Display name and result
    
```

Use the test data that follows and the names 'John' and 'Dave' as input data to test the algorithm.

Use line numbers to identify and explain the logical errors encountered.

Test data:

0	1	2	3	4
Peter	Sam	John	Wayne	Gary

(6)

Line 4 ✓ An additional test condition is required – need to test for the size of the array with (counter < array size) ✓

7 ✓ The increase of the counter should not be part of the IF-statement ✓

8✓ Any ONE of: ✓

- Setting the flag to false must be removed – because the current loop will then be an infinite loop
- with the correction to line 4 the loop will terminate when the size of the array is reached and found will have the value of false

5.3.2 In the above code the loop is terminated using the boolean variable found.

Describe another way that a loop can be terminated.

(2)

Return statement will cause loop to end and pass control back to calling method or break ✓ will cause control to go to end of loop. ✓

5.4 The programmer who created the application software used object-orientated programming (OOP) principles. Study the class diagram below and answer the questions that follow.

5.4.1 Identify a suitable data structure that can be used to store a collection of athlete objects. (1)

Any ONE suitable data structure for collection of athletes✓:

- Array/List/Vector
- Text file/binary file/file of records/XML-data files
- Recordset based on a database table

5.4.2 Explain why the class shown in the diagram violates the principle of information hiding. (2)

Some fields are public and methods private✓, fields should be private and methods control how fields are manipulated. ✓

5.4.3 Using Object Oriented Principles, what type should the DateOfBirth field be declared as? Explain your answer. (3)

Date✓ – the date type has methods that can be used for validation and calculations. ✓✓

5.4.4 Two constructors are included in the class diagram. This is known as overloading.

(a) Explain why it is advisable to have these two constructors from the point of view of application development. (2)

Explain why overloading of constructors is required ✓✓

- An object may need to be instantiated with or without values depending on if the values of the attributes are known at the time of instantiation.
- When setting up an athletics meeting the names of all the athletes going to participate are not always known and therefore it may require that a “blank/empty” athlete is created to allocate memory for the object – with registration

(b) Can methods, other than constructors, also be overloaded? (1)

Yes✓

5.4.5 The following method call was made:
IsValidDateOfBirth(day,month,year)

Give TWO problems with the call statement. Name the type of error that will occur with each problem (syntax/run time/logical). (4)

Any TWO reason for error: ✓ and type of error✓

- The list of parameters differs from the method declaration OR There is no overloaded version of this method with different sets of parameters.

Not called as a typed method

5.5 The following data structures can be used to store and manipulate data in a program:

- A two-dimensional array
- An array of type string
- A string
- An array of objects

In each of the following cases, decide which ONE of the above will be the best to use:

- 5.5.1 A list of names of the 15 cities where some of the athletics meetings will take place (1)

Array of Strings✓

- 5.5.2 All the details of each of the 15 organisers of the athletics meetings, including their names and contact details (1)

Array of objects✓

- 5.5.3 The title of an athletics meeting (1)

String✓

- 5.5.4 Booking of seats at one of the athletics meetings (1)

2D array✓

- 5.6 An array called **arr** has many duplicates. An algorithm needs to be developed to determine how many times each number occurs. For example in the following array:

arr

0	1	2	3	4	5	6	7	8	9
A	Z	B	A	Z	Z	A	J	A	J

Should produce the following string:

A occurs 4 times, Z occurs 3 times, B occurs 1 times, J occurs 2 times.

Write your solution in **pseudocode** using an adaptation of the selection sort algorithm. (14)

```

size ← 10✓
for out ← 0 to size-1✓✓
    count ← 0✓
    for in ← out+1 to size✓✓
        if arr[out] == arr[in] ✓✓
            count++✓✓
        end for
        if arr[out] not in temp ✓✓
            then
                temp = temp + arr[out] "occurs" + count + "times"; ✓ ✓
            end inner for
    end outer for

```