INFORMATION TECHNOLOGY: PAPER I

MARKING GUIDELINES

Time: 3 hours   180 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A   SHORT QUESTIONS

QUESTION 1   DEFINITIONS

1.1   Processing technique where multiple tasks are processed on more than one physical processor/core.
       Accept: any reference to multiple cores on a single CPU
1.2   Combination of fields and methods into a class.
1.3   A publication/book made available in digital/electronic form.
1.4   A private method in an object/class A method which assists/uses another method - one mark. Must mention private for second mark.
       Do not accept: helps another method.
       Accept: "not accessible outside the class" as an alternative for private.
1.5   The process of locating the non-contiguous fragments of data into which a computer file may be divided as it is stored on a hard disk, and rearranging the fragments and restoring them into fewer fragments or into the whole file. Accept arranging fragments together; Accept rearrangement; Don't accept files. Accept improving performance for second mark. Don't accept free up storage.

QUESTION 2   MATCHING COLUMNS

2.1   E

2.2   O

2.3   F

2.4   H

2.5   C

2.6   P

2.7   D

2.8   L

2.9   A

2.10   M

SECTION B   SYSTEM TECHNOLOGIES

3.1   Any valid device: mouse, printer, scanner, etc.
       For drives, must say **external**; accept network card; monitor.

3.2   3.2.1   There are more USB 2.0 devices in common use than 3.0; rather use
                a 2.0 device in a 2.0 port to not take a 3.0 port away from a 3.0
                device. USB 2.0 is for legacy devices. ANY ONE. Accept backwards
                compatibility; cheaper to manufacture on motherboard.

       3.2.2   Mouse doesn't transfer a lot of data, no need for higher-speed
                connection. ANY ONE.

3.3   3.3.1   Linux suitable for servers in terms of resource allocation, lighter
                demands compared to other OS, cost. ANY ONE. Accept Free;
                adaptable. Don't accept "easy to use"

       3.3.2

	Linux	Windows
Licencing	**Open source, some versions free, others paid for.** Accept copyleft ; GNU	**Propriety licence purchased, licence key, 1 per PC.** Accept copyright
User support	**Mostly via online community. Purchased versions come with some support.** No official support, no vendor support	**Support via Microsoft either online or phone.**

3.4   3.4.1   Available slots on the motherboard and size of RAM chips available;
                ability of motherboard components to address more RAM, bus design
                and size. ANY ONE
                Accept size of FSB/A address bus/bus in general; number of RAM
                slots.

       3.4.2 2^{64} One mark for base (2) and one mark for exponent (64).
                Accept 1.87447×10^{19}

       3.4.3   Multiply by 8

3.5   3.5.1   The network card can transfer data at any one of the three
                transmission speeds: 10, 100 or 1000 Mb/s. Bandwidth

       3.5.2   The network card can have either a UTP or fibre cable connection.
                Accept STP in place of UTP, Coax.

3.6   3.6.1   SRAM Accept Static RAM

       3.6.2   Cache stores copies of data and instructions from frequently used
                memory locations in a bid to improve processing speed and
                efficiency.

Accept: A type of memory located close to CPU, in CPU.
Accept pre/post data
Any 2 functions of cache
Don't accept SRAM

3.7   **Advantage:** no need for additional I/O cards.   faster
      Disadvantage: uses main system resources.   slower
      Accept can't upgrade graphics card; not modular; extra cost

Do not accept both

3.8   3.8.1   **Multithreading:** will allow or multiple threads/processes of programs to be executed simultaneously giving the end user greater performance benefits when using software designed to take advantage of the technology. Do not accept examples
OR a single program can run multiple threads at the same time, e.g. downloading a file in Chrome and searching in 2 tabs.
Hyper-threading: will allow for more efficient use of the processor resources by **simulating** additional execution units and thus allowing for greater CPU utilization, fewer lags for users. However, it does not offer performance improvements in all applications.
OR TWO sets of registers/logical processors on the CPU to enable fast context switching.

3.8.2   Peter and Sam could be updating Facebook while printing invoices and sending emails. One mark for two things running, second mark must imply understanding of multithreading and hyper-threading. Concept of one app, two things. Don't accept faster.

3.9   3.9.1

CPU Type	Amount of RAM	HDD type and capacity	Operating System
(a)	(b)	(b)	(a)

Mark 3.9.1 and 3.9.2 together. Accept alternative answers if sufficiently justified in 3.9.2.
Excessive options (eg: i7, 12GB RAM) must be justified by 3.9.2.
Mark 3.9.2 first to assess reasoning, then come back to mark 3.9.1

3.9.2   CPU Type:
- The number/type of applications guests will be running – not demanding therefore i3 is probably most appropriate.
- i5 processor should be acceptable. -
- i7 – difficult to motivate in this scenario.

RAM:
- Accept 4 GB as most suitable answer – unlikely to be running multiple large applications at once; one user at a time.

HDD:
- 1 TB most suitable from cost perspective as a guest machine, sufficient space for guests to download photos.
- SSD quite small for the task.

Operating system:
- Windows 10 or similar recent version – guests are used to using.
- Accept Mac OS – overseas guests might be more used to using this.
Do not accept Linux
One mark each.

If chose high specs (processor or HDD/SSD) – justify with video editing, upload to Facebook, etc

3.10   InkJet printer – there will be SMALL but REGULAR print volumes, fairly cheap to purchase in the first instance, can get colour printer for reasonable cost in case visitors want that facility.
OR
Colour laser – high quality for photos lower replacement cost for cartridges
Any correct, reasonable answer related to scenario.
Accept: B&W LASER Wireless printer; Photo printer
Don't accept "easier to use"

3.11   Medium – probably an external HDD or USB memory stick; could back up to DVD of Blu-ray. Accept NAS/SAN; accept cloud; accept google drive, dropbox; similar options.
Don't accept "the Internet" unless answer clearly shows this is as a mechanism to store.

Location – best to not be in the same room as the server. Maybe do backups and keep the drive somewhere else; Cloud is another option.

Backup schedule – minimum of once per day, morning and evening would be better; as data storage needs increase, might need to change to 4 hourly or continuously, particularly if database data is stored.
OR
Alternative: could use a cloud-based back-up system: located off site, large HDD pool used, usually back up once a day.

Other factors/options: Accept: A brand of cloud service (NOT "Google");
Accept UPS – backups will fail if power is out; Differential/Incremental

SECTION C   INTERNET AND COMMUNICATION TECHNOLOGIES

QUESTION 4

4.1   4.1.1   Wireless AP: hardware device that allows various devices to connect to a network. Accept connect to a LAN. Don't accept connect to Internet.

        4.1.2   Network topology: the physical or logical layout or arrangement of a network. Accept Arrangement of computers.

4.2   4.2.1   Encryption: a security process to ensure that data being transmitted over a wireless network is difficult to read.
                OR conversion of data to unreadable form. ANY TWO

        4.2.2   Very short key – usually 40 bit but up to 256 bit is supported. Key can very easily be broken allowing for data to be decrypted. WEP relies on a single shared key for users, leads to weakness of system. Even the longer key sizes are still vulnerable to a number of security problems.
                Security flaws. ANY TWO.
                Accept: Symetric Cryptography -> leads to a shared key = weakness.
                (WEP uses RC4 and CRC32)

        4.2.3   (a)   256 bits

                (b)   Stronger data protection network access control
                        ANY TWO.

4.3   4.3.1   An unique identifier assigned to a network interface used in network communications.

        4.3.2   An identifier assigned to each node on a TCP/IP network to locate and identify the node. Accept an example such as 125.0.16.3

        4.3.3   (a)   Because the pool of available IPv4 addresses was too small for the needs of IP addressing.
                OR   Ran out of IPv4 addresses.

                (b)   IPv4 $->$ 32 bits
                        IPv6 $->$ 128 bits

4.4   4.4.1   Option 1 – UTP
                 Option 2 – Fibre
                 Option 3 – Wi-Fi
                 Accept STP, radio waves, microwave

4.4.2   Option 1 – UTP: $->$ good if less than 100 m apart, cheap medium, would need to be underground – costly underground installation, susceptible to lightning.
Option 2 – Fibre: $->$ no distance limitations, additional equipment at each end to convert back to UTP, no lightning issues.
Option 3 – Wi-Fi: $->$ distance limited but can repeat, simple to install, lower installation costs, unsightly transmitters, affected by weather conditions. ANY TWO.
Mark this question in relation to 4.4.1 for each Advantage/ Disadvantage.

4.5   4.5.1   A system where live video is streamed over the Internet
Accept over network; choice from catalogue supplied by B&B; whenever guests want to watch.

4.5.2   UDP

4.5.3   • Lower bandwidth utilization than, say TCP;
• great for a use where it doesn't matter if some packets get lost;
• latency is lower so applications that need low latency survive better. ANY TWO

4.6   4.6.1   **ADVANTAGES**
• They have easy control over the site;
• can make it available locally on their network even if the Internet link is down;
• no additional hosting costs. ANY TWO
DISADVANTAGES
• Will possibly make the server open to attack;
• website could be "down" if power is off or connectivity is down – potential bookings lost;
• need to be skilled in making updates.
• Space on server may be limited. ANY TWO
REASONS – not cheaper/faster

4.6.2   (a)   To monitor incoming and outgoing packets in order to block traffic that might come from an untrusted source.
Accept: to filter content

(b)   Yes.
• As soon as there is web traffic coming to the machine from outside there is a chance of an attack to the website;
• additionally the server could be attacked and made a sender of spam blocking their external IP address – people won't be able to communicate with them, could launch an attack against the server itself, stealing data.

Really convincing for a "No" answer!

4.7   4.7.1   HTTPS Accept: SSL Don't accept TCP

4.7.2   Digital Certificate
Don't accept "certificate"; "s" at the end of http

4.7.3 (a)   **Server-side:** a technique used when developing web pages where scripts are run on a web server to produce a response for each client request to the website. **Client-side:** the same as server-side scripting except the scripts runs in the client's browser, not on the server. The processing thus takes place at the client side. Must show understanding of Remote vs Local.

      (b)   Client-side

4.8   4.8.1 A hardware (or software) technique whereby data is replicated over multiple drives to ensure data redundancy in the event of hardware failure. *Must mention hardware failure. Accept copy of data.

     4.8.2 (a)   RAID 1: 2 hard drives RAID controller installed. Provided they are not using more than 4 TB of storage space, no upgrade needed.

          (b)   I would recommend RAID 1: drive mirroring should be adequate in this scenario. Decrease in performance from RAID 1 shouldn't be an issue for a small processing environment.
Accept RAID 5 provided they show they understand. One mark for choice, one for reason

4.9   Accept any option: Google Apps/iCloud/AWS/Office 365
Accept SAAS. Do not accept: Gmail.
Acceptable factors: look at up-time; storage limitations; what is provided free, what is an extra cost; level of integration between apps

SECTION D   SOCIAL IMPLICATIONS

QUESTION 5

5.1   Facebook; Twitter; Instagram; blog; register with travel services such as Booking.com/TripAdvisor; Develop an App; SEO; Airbnb.
ANY THREE

5.2   5.2.1   The firewall will only check incoming and outgoing traffic – will not check what is happening on, say, the guest computer that could be infected by a virus, which could then cripple the entire network.

         5.2.2   No. An email message will not be checked by the anti-virus.

         5.2.3   Twice daily, daily at the least. There are a lot of new threats coming out on a daily basis – need to be kept up to date. In a time where there is an escalated threat level, raise the number of times per day. Accept anything which suggests this must happen often, eg: As often as possible.

         5.2.4   There are frequent updates to operating systems and other applications, which either add new functionality or patch security flaws. They should keep operating systems and applications up to date in order to ensure they are not vulnerable. Accept Driver updates.

5.3   5.3.1   Junk Mail OR SPAM Accept: Intentional **very regular** mail shot

         5.3.2   ANY ONE
                 • Check the header information of the email for detail about the sender;
                 • phone The B&B and ask them; reply to an email but before sending it, hover over the TO field and look at the email address, which is shown in the mail client embedded in the name.
                   Accept: Digital Signature; match email address

5.4   5.4.1   It is illegal to give personal information to third parties without their consent;
                 OR: The B&B want to maintain good relations with their clients so don't want them to be spammed/receive SMSs.
                 MUST have concept of illegality for second mark

         5.4.2   Police investigation/criminal.

SECTION E   DATA AND INFORMATION MANAGEMENT AND SOLUTION DEVELOPMENT

6.1   Accuracy: data must be accurate to be of any processing use. A batch of inaccurate data will skew statistics or analysis.
Consistency: having data that is not consistent from one period to another will lead to inaccuracies in reporting.
Timeliness: data that is out of date is of no use to draw conclusions about current trends.
Completeness: a data set with missing data cannot give an accurate picture or position when analysed. ANY TWO.
Accept Validity/currency/relevance/correctness/reliability

6.2   6.2.1   SQL Injection Accept Injection

6.2.2   To effectively produce a list of **all** account numbers and associated balances. Will always return true = one mark.

6.3   6.3.1   Credit card transactions; social networking profiles; activity generated data (internet of things items); legacy data; media; machine-logged data; data uploaded to public websites.
ANY THREE
Accept Cookies; Google

6.3.2   Similar purchasing: they will look at the sort of things you have bought historically from them and suggest to you new items you might like to buy that are similar. For example, new DVDs which have a similar theme to those you bought before.

Birthdays: if they have access to public information which includes information about people from your social networking profiles they can remind you to get a gift for a friend when their birthday is coming up; they can then look at the sort of things that person has bought from them in the past (if they have a shopping history) and suggest the type of gift you might like to buy your friend.

New recommendations: if you have a fitness device that is supplying data which can be accessed publically and can be linked to you, they might offer you items of sports clothing related to your activity.

Spending trends: they can see when you generally spend more money than at other times in a year and make sure they contact you more frequently at that time of the year with offers.
ANY TWO. One mark for naming and one mark for explanation for each answer.

6.4

Field Name	Data Type
Guest Name	String
GuestID	Number (Integer) or String Accept: Auto Number
Reservation Start date	Date/Time
Reservation End date	Date/Time
Room Number	**Number (Integer)**
Room Capacity	Number (Integer)
Room Rate	**Currency**
Booking Reference	**String**

Bold items have been given to candidates.
Mark allocation: 1 mark each, 1 mark for both the date fields.

6.5   In order to work out duration of stays; to be able to see when rooms are booked/available.

6.6

Option 1:
Bookings (BookingRef; GuestID; StartDate; EndDate)
Rooms (RoomNumber; RoomCapacity; Rate BookingRef)
Guests (GuestID, GuestName)

Option 2
Bookings (BookingRef; GuestID; StartDate; EndDate RoomNumber)
Rooms (RoomNumber; RoomCapacity; Rate)
Guests (GuestID, GuestName)

6.7   Partial – field is dependent on part of a composite key.
Transitive – field is dependent on a non-key field.
Do not accept full dependency

QUESTION 7

7.1   7.1.1   It improves the algorithm by stopping the sort once the array has been sorted.
                If function of while loop vs for loop functionality discussed generally – one mark
                If candidate explains in terms of this algorithm, i.e. WHY; no more swaps will take place – second mark

         7.1.2 TRUE.

7.2   method searchStop (int inValue)   for parameter

         i ← 0
         flag ← false
         size ← size of valArr   for all declarations
         pos ← −1
         while (i < size AND flag = false)
           if (inValue = valArr[i])
              flag ← true
              pos ← i   for both assignments
            end if
           i ← i + 1
         end while
         return pos

         Variable names must be the same as in question:
         deduct one mark once for errors
         Does not terminate when found but code is correct – minus two marks
         Deduct 2 marks if Java or Delphi code is written
         For loop and force an exit – minus two marks

         Summary:
         Header/parameter
         Variables needed are shown and initialised
         Correct loop
         Correct test / assignment / increment
         Correct return

7.3

Booking

Properties
    −   String name
    −   String startdate
    −   String enddate

Methods
    +   Constructor(String n, String sd, String ed)
    +   getName(): String
    +   getStartDate(): String
    +   getEndDate(): String
    +   setName(na: String)
    +   setStartDate(sdt: String)
    +   setEndDate(edt: String)
    +   calcDuration(): Integer
    +   toString(): String

Mark allocation:
One mark for name of class
One mark to show all properties as private
One mark for methods to be shown as public
One mark for properties correctly named and typed
Accept any number of properties entered. Some candidates might use all the properties from Q 6.4.
Two marks for correct constructor with correct number of parameters
Accept constructor name as Booking ; Ignore types here
One mark for a correct getter and a correct setter
One mark for the toString() method with correct type
One mark for the calcDuration method: correctly named and typed.

Total: 180 marks