

Answers of Data Security

Answer 1

Question	Answer	Marks								
1(a)	<p>1 mark for each correctly completed term.</p> <p>Validation checks that the data entered is reasonable. One example is a presence check.</p> <p>Verification checks that the data entered is the same as the original. One example is double entry.</p>	4								
1(b)	<p>1 mark for each correct entry</p> <table><tr><th>Security measure</th><th>Description</th></tr><tr><td>Disk mirroring</td><td>Data are written on two or more disks simultaneously.</td></tr><tr><td>Encryption</td><td>Contents are scrambled so they cannot be understood without a decryption key</td></tr><tr><td>Backup</td><td>A copy of the data is taken and stored in another location</td></tr></table>	Security measure	Description	Disk mirroring	Data are written on two or more disks simultaneously.	Encryption	Contents are scrambled so they cannot be understood without a decryption key	Backup	A copy of the data is taken and stored in another location	3
Security measure	Description									
Disk mirroring	Data are written on two or more disks simultaneously.									
Encryption	Contents are scrambled so they cannot be understood without a decryption key									
Backup	A copy of the data is taken and stored in another location									

Answer 2

7(d)(i)	1 mark per bullet point to max 2 <ul style="list-style-type: none"> Prevents unauthorised access to the data Monitors incoming and outgoing traffic Blocks transmissions from unauthorised sources / websites / ports Maintains an allow list / deny list of IP addresses 	2
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Question	Answer	Marks
7(d)(ii)	1 mark only from: <ul style="list-style-type: none"> Running up-to-date antivirus software Use of proxy server Strong / Biometric passwords Etc. 	1


Answer 3

5(a)	1 mark per bullet point to max 3 <ul style="list-style-type: none"> Encryption scrambles the source code (so it is meaningless) ... using an encryption key / algorithm If the file is accessed without authorisation it will be meaningless It requires a decryption key / algorithm to unscramble 	3
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Answer 4

4(b)	1 mark per bullet point to max 2 × 2 Data backup <input type="checkbox"/> A copy of data will have been made and stored elsewhere. <input type="checkbox"/> If the original is lost, the backup can be used to restore the data. Disk-mirroring <input type="checkbox"/> The data is stored on two disks simultaneously. <input type="checkbox"/> If the first disk drive fails, the data is accessed from the second disk.	4
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Answer 5

2(a)	1 mark per bullet point <input type="checkbox"/> Security: keep data safe from accidental/malicious damage/loss <input type="checkbox"/> Privacy: keep data confidential // only seen by authorised personnel	2
2(b)	1 mark for identifying method 2 marks for description to max 2 × 3 For example: <input type="checkbox"/> User accounts <input type="checkbox"/> User has a username and password Access to resources can be limited to specific accounts <input type="checkbox"/> Cannot access <u>system</u> without valid username and password // prevents unauthorised access to the <u>system</u> <input type="checkbox"/> Firewall <input type="checkbox"/> All incoming and outgoing network traffic goes through firewall <input type="checkbox"/> Blocks signals that do not meet requirements <input type="checkbox"/> Keeps a log of signals <input type="checkbox"/> Applications can have network access restricted <input type="checkbox"/> Anti-malware <input type="checkbox"/> Scans for malicious software <input type="checkbox"/> Quarantines or deletes any malicious software found <input type="checkbox"/> Scans can be scheduled at regular intervals <input type="checkbox"/> Should be kept up to date <input type="checkbox"/> Auditing <input type="checkbox"/> Logging all actions/changes to the system <input type="checkbox"/> In order to identify any unauthorised use <input type="checkbox"/> Application Security (accept equivalent) <input type="checkbox"/> Applying regular updates / patches <input type="checkbox"/> Finding, fixing and preventing security vulnerabilities in any (installed) application	6
2(c)(i)	1 mark per bullet to max 4 <input type="checkbox"/> Each byte has a parity bit // horizontal parity <input type="checkbox"/> An additional parity byte is sent with vertical (and horizontal) parity <input type="checkbox"/> Each row and column must have an <u>even/odd number of 1s</u> <input type="checkbox"/> Identify the incorrect row and column <input type="checkbox"/> The intersection is the error	4
2(c)(ii)	1 mark for correct answer <input type="checkbox"/> Errors in an even number of bits (could cancel each other out)	1 

Answer 6

1(c)(ii)	<p>1 mark for each security method to max 2, 1 mark for integrity</p> <p>Security</p> <ul style="list-style-type: none"> <input type="checkbox"/> encryption <input type="checkbox"/> access rights <input type="checkbox"/> username and password // biometrics // user accounts <input type="checkbox"/> backup // disk mirroring <input type="checkbox"/> firewall <input type="checkbox"/> Physical methods (e.g. CCTV, locked rooms etc.) <p>Integrity</p> <ul style="list-style-type: none"> <input type="checkbox"/> checksum <input type="checkbox"/> parity <input type="checkbox"/> validation on input 	3
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Answer 7

6(b)(i)	<p>1 mark for the correct bit circled</p> <table><tr><td>Parity bit</td><td colspan="8">Data</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>Parity byte</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr></table>	Parity bit	Data								1	1	0	1	0	1	1	1	1	0	0	0	1	1	1	0	0	1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	Parity byte	1	1	1	1	1	0	0	1	1
Parity bit	Data																																																			
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Parity byte	1	1	1	1	1	0	0	1																																												
6(b)(ii)	<p>1 mark for each bullet point</p> <ul style="list-style-type: none"><input type="checkbox"/> row and column has incorrect parity (odd instead of even)<input type="checkbox"/> the intersection identifies the error	2																																																		
6(c)	<p>1 mark per bullet to max 2</p> <ul style="list-style-type: none"><input type="checkbox"/> Errors in an even number of bits (in the same row or column)<input type="checkbox"/> Prevents error being identified<input type="checkbox"/> Could appear to be correct	2																																																		
6(d)	<p>1 mark for the name and max 2 marks for description</p> <ul style="list-style-type: none"><input type="checkbox"/> Check sum<input type="checkbox"/> A calculation is done on a block of data<input type="checkbox"/> The result is transmitted with the data<input type="checkbox"/> Calculation repeated at receiving end<input type="checkbox"/> Results compared<input type="checkbox"/> If different an error has occurred <input type="checkbox"/> Hash total<input type="checkbox"/> Total of several fields of data<input type="checkbox"/> Including fields not usually used in calculations<input type="checkbox"/> The result is transmitted with the data<input type="checkbox"/> Calculation repeated at receiving end<input type="checkbox"/> Results compared<input type="checkbox"/> If different an error has occurred	3																																																		

Answer 8

Question	Answer	Marks																																																						
3(a)	1 mark for correct parity bit Parity bit <table><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>	0	0	1	0	0	0	0	0	1																																														
0	0	1	0	0	0	0	0																																																	
3(b)	1 mark for the correct bit circled. <table><tr><td></td><td>Parity bit</td><td colspan="7">Data</td></tr><tr><td></td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td></td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>Parity byte</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr></table>		Parity bit	Data								1	0	1	0	1	1	1	1		0	1	1	0	0	1	1	0		1	1	0	0	0	0	0	0		0	1	0	0	0	0	0	0	Parity byte	0	0	0	0	1	0	0	1	1
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Parity byte	0	0	0	0	1	0	0	1																																																
3(c)	1 mark per each correct row <table><tr><th>Measure</th><th>Validation</th><th>Verification</th></tr><tr><td>Checksum</td><td></td><td>✓</td></tr><tr><td>Format check</td><td>✓</td><td></td></tr><tr><td>Range check</td><td>✓</td><td></td></tr><tr><td>Double entry</td><td></td><td>✓</td></tr><tr><td>Check digit</td><td>✓</td><td></td></tr></table>	Measure	Validation	Verification	Checksum		✓	Format check	✓		Range check	✓		Double entry		✓	Check digit	✓		5																																				
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Answer 9

4(a)	Parity bit <table><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr></table>	1	0	1	1	1	0	1	0	1																																										
1	0	1	1	1	0	1	0																																													
4(b)	1 mark for correctly circled bit <table><tr><td>Parity bit</td><td colspan="8">Data</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>Parity byte</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr></table>	Parity bit	Data								0	0	1	1	0	1	0	1	1	1	1	1	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1	1	0	1	1	Parity byte	0	1	1	1	1	1	0	1	1
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0	0	0	1	1	0	1	1																																													
Parity byte	0	1	1	1	1	1	0	1																																												

4(c)	<p>1 mark for each correct line</p> <p>Error detection measure</p> <pre> graph LR TC[Type check] --> V[Verification] TC --> Val[Validation] PR[Proof reading] --> V PR --> Val CD[Check digit] --> V CD --> Val CS[Checksum] --> V CS --> Val </pre>	4
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Answer 10

5(a)(i)	<input type="checkbox"/> Count the number of one bits in the <u>first seven</u> bit positions 1 <input type="checkbox"/> Add a 0 or 1 to bit position 0, to make the count of one bits an <u>odd</u> number 1	2																																																																																
5(a)(ii)	A = 1 B = 1	1																																																																																
5(a)(iii)	<p>Two from:</p> <input type="checkbox"/> A parity bit is worked out for each <u>column</u> 1 <input type="checkbox"/> The computer checks the parity of each bit position in parity byte // the computer generates copy of the parity byte and <u>compares</u> 1 <input type="checkbox"/> If incorrect parity then there is an error in the data received // No parity error means no error in the data received 1 <input type="checkbox"/> The position of the incorrect bit can be determined 1	2																																																																																
5(b)(i)	<table border="1"> <tr> <th colspan="8">Bit position</th> </tr> <tr> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>	Bit position								7	6	5	4	3	2	1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	2
Bit position																																																																																		
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5(b)(ii)	<p>Three from:</p> <input type="checkbox"/> Consider each row in sequence 1 <input type="checkbox"/> Identify any row with incorrect parity 1 <input type="checkbox"/> Repeat the process for each column in sequence 1 <input type="checkbox"/> Identify where a row and column with incorrect parity intersect 1	3																																																																																

Answer 11

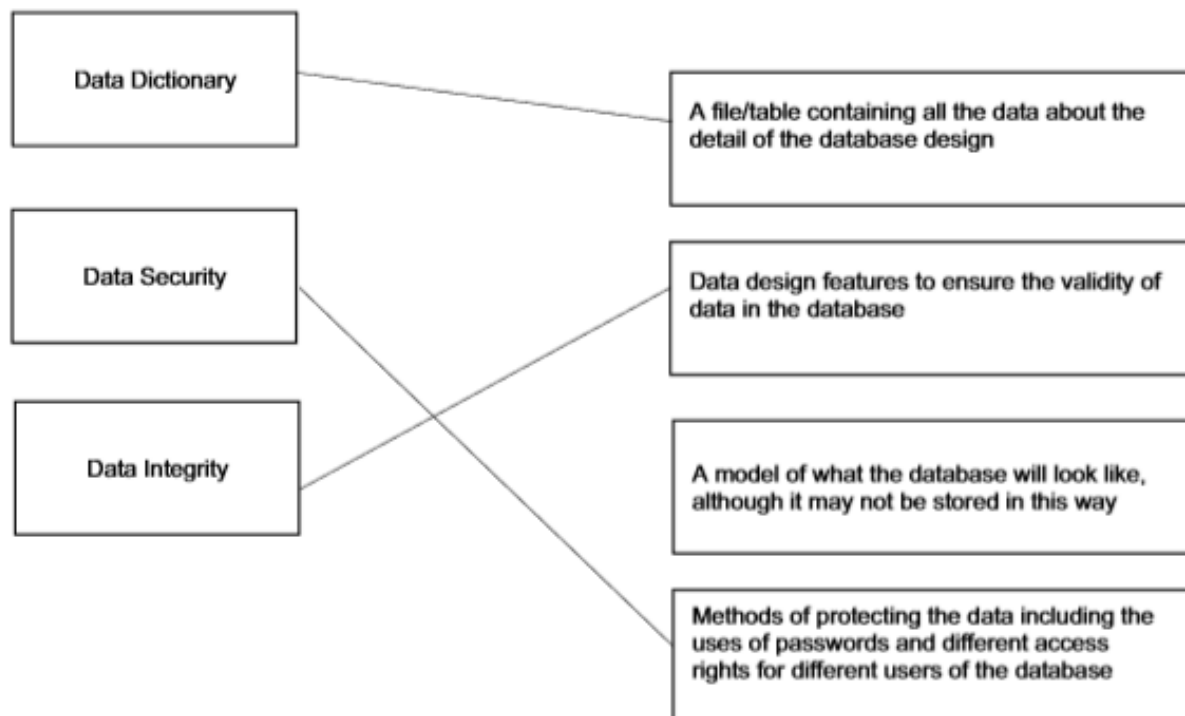
3(a)	Two marks from: <input type="checkbox"/> Physical measures <input type="checkbox"/> Access rights <input type="checkbox"/> Encryption <input type="checkbox"/> Firewall <input type="checkbox"/> Use authentication methods such as usernames and passwords <input type="checkbox"/> Anti-malware program	Max 2																																													
3(b)(i)	<table border="1"><tr><td>7</td><td>X</td><td>6</td><td>=</td><td>42</td></tr><tr><td>8</td><td>X</td><td>5</td><td>=</td><td>40</td></tr><tr><td>6</td><td>X</td><td>4</td><td>=</td><td>24</td></tr><tr><td>5</td><td>X</td><td>3</td><td>=</td><td>15</td></tr><tr><td>3</td><td>X</td><td>2</td><td>=</td><td>6</td></tr><tr><td>1</td><td>X</td><td>1</td><td>=</td><td>1</td></tr><tr><td colspan="4">Total:</td><td>128 / 11</td></tr><tr><td colspan="4"></td><td>11 R 7</td></tr><tr><td colspan="4">Check digit:</td><td>11 - 7 = 4</td></tr></table> <p>1 mark for 6 values</p> <p>1 mark for 2 steps Accept 128 MOD 11 = 7</p> <p>1 mark for subtraction</p> <p>Answer: 786531 4 (1 mark for answer)</p>	7	X	6	=	42	8	X	5	=	40	6	X	4	=	24	5	X	3	=	15	3	X	2	=	6	1	X	1	=	1	Total:				128 / 11					11 R 7	Check digit:				11 - 7 = 4	4
7	X	6	=	42																																											
8	X	5	=	40																																											
6	X	4	=	24																																											
5	X	3	=	15																																											
3	X	2	=	6																																											
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Check digit:				11 - 7 = 4																																											
3(b)(ii)	One mark for name of check One mark for description Max two checks Uniqueness check Each PatientID must be unique Length check Each PatientID is exactly 7 characters Format check / Type check All 7 characters must be <u>digits</u> Presence check PatientID must be entered	Max 4																																													

Answer 12

3(a)(i)	1 Mark per bullet, max 3 <ul style="list-style-type: none"> <input type="checkbox"/> Security is keeping the data safe <input type="checkbox"/> From accidental / malicious damage /loss <input type="checkbox"/> By example of need for security <input type="checkbox"/> Privacy is the need to restrict access to personal data <input type="checkbox"/> To avoid it being seen by unauthorised people <input type="checkbox"/> By example of need for privacy 	3
3(a)(ii)	1 Mark for a suitable example For example: Personal data of students / staff	1

3(a)(ii)	<p>1 Mark for a suitable example For example: Personal data of students / staff</p>	1
3(b)	<p>1 Mark for stating the security measure 1 Mark for a corresponding description Maximum 2 marks for each measure Maximum 2 measures</p> <p>Physical measures</p> <ul style="list-style-type: none"> <input type="checkbox"/> Locked doors/keyboards etc. <input type="checkbox"/> Secure methods of access, keypads/ biometric scans etc. <p>Backup of data</p> <ul style="list-style-type: none"> <input type="checkbox"/> Regular copies of the data are made <input type="checkbox"/> If the data is corrupted it can be restored <p>Disk-mirroring</p> <ul style="list-style-type: none"> <input type="checkbox"/> All activity is duplicated to a second disk in real time so that if the first disk fails there is a complete copy available <p>Access rights</p> <ul style="list-style-type: none"> <input type="checkbox"/> Different access rights for individuals/groups of users <input type="checkbox"/> To stop users editing data they are not permitted to access <input type="checkbox"/> By example <p>Encryption</p> <ul style="list-style-type: none"> <input type="checkbox"/> If accessed, data cannot be understood by unauthorised personnel <input type="checkbox"/> Accessed only by those with the decryption key <p>Firewall</p> <ul style="list-style-type: none"> <input type="checkbox"/> To stop unauthorised access/hackers gaining access to the computer network <p>Use authentication methods such as passwords and usernames</p> <ul style="list-style-type: none"> <input type="checkbox"/> Passwords should be strong / biometrics <input type="checkbox"/> To prevent unauthorised access to data <p>Anti-malware program</p> <ul style="list-style-type: none"> <input type="checkbox"/> To detect / remove / quarantine viruses / key-loggers etc. <input type="checkbox"/> Carrying out regular scans <p>Concurrent Access Controls // Record locking</p> <ul style="list-style-type: none"> <input type="checkbox"/> Closes a record to second user until first update complete <input type="checkbox"/> To prevent simultaneous updates being lost 	4
3(c)	<p>1 Mark per bullet, max 2</p> <ul style="list-style-type: none"> <input type="checkbox"/> Checking that the data entered matches / is consistent with that of the source. <input type="checkbox"/> Comparison of two versions of the data <input type="checkbox"/> Examples include double entry, visual checking, proof reading etc... <input type="checkbox"/> In the event of a mismatch – the user is forced to re-enter the data <input type="checkbox"/> By example, e.g. creation of a password <input type="checkbox"/> Does not check data is sensible/acceptable 	2

Answer 13



(b) **One mark** for procedure point, **one mark** for justification.

[6]

Maximum **three** procedures.

- How often should the data be backed up? e.g. at the end of each day
- Justification e.g. student's progress may be edited each day and should not be lost

- What medium should the data be backed up to? e.g. external hard disk drive
- Justification e.g. it has large enough capacity

- Where should the backups be stored? e.g. off-site
- Justification e.g. so if the building is damaged only the original data are lost

- What is backed up? e.g. only updated files ...
- Justification e.g. There are a large number of files and they are not all updated each day

- When should the backup take place? e.g. overnight
- Justification e.g. the system is not likely to be used then

- Who is responsible for performing the backup?
- Justification e.g. otherwise it may not be done

- Make sure the procedure is written down and understood by staff
- Justification e.g. otherwise some data may not be backed up



Answer 14

(a) Four from:

[4]

- Security is keeping the data safe.
- Integrity is making sure that the data is correct / valid.
- Security is the prevention of data loss.
- Integrity ensures that the data received is the same as the data sent / data copied is the same as the original.
- Example of ensuring security, e.g. usernames and passwords, firewalls etc...
- Example of ensuring integrity, e.g. parity checks, double entry etc...

(b) Three pairs from:

[6]

- Installing a firewall and ensuring it is switched on.
- To stop unauthorised access / hackers gaining access to the bank's computer network.
- Use authentication methods such as passwords and usernames.
- Passwords should be strong / biometrics.
- Encrypt the data.
- So that if data is accessed it will be meaningless / only accessed by those with decryption key.
- Set up access rights...
- To stop users reading/editing data they are not permitted to access.
- Installing and running an up to date anti-malware program (anti-virus/anti-spyware etc.).
- To detect / remove / quarantine viruses / key-loggers etc.
- Make regular backups of the data.
- To separate device or off site to enable recovery if necessary.
- Employ measures for physical security.
- Example of a measure for physical security.

Answer 15

- (c) (i) • Hackers can still access the data (and corrupt it, change it or delete it)
 • Encryption simply makes data incomprehensible (without decryption key / algorithm) [2]

(ii) Any two from:

- This is an explanation of data verification (not validation)
- Data validation ensures that data is reasonable / sensible / within a given criteria
- Original data may have been entered correctly but is not reasonable (e.g. age of 210) [2]

- (iii) • A password does not prevent unauthorised access, it makes it more difficult
 • Password can be guessed (if weak) // Password can be stolen // A relevant example of misappropriation of password [2]

Answer 16

- (a) maximum of **two marks** for firewall description + maximum of **two marks** for authentication description

Firewall

- sits between the computer or LAN and the Internet/WAN and permits or blocks traffic to/from the network
- can be software and/or hardware
- software firewall can make precise decisions about what to allow or block as it can detect illegal attempts by specific software to connect to Internet
- can help to block hacking or viruses reaching a computer

Authentication

- process of determining whether somebody/something is who/what they claim to be
- frequently done through log on passwords/biometrics
- because passwords can be stolen/cracked, digital certification is used
- helps to prevent unauthorised access to data [3]

- (b) **one mark** for security, **one mark** for integrity:

- integrity deals with validity of data/freedom from errors/data is reasonable
- security deals with protection of data
- security protects data from illegal access/loss
- integrity deals with making sure data is not corrupted after, for example, being transmitted [2]

- (c) (i) **one mark** for each way of maintaining data security + **one mark** for an example/enhancement

- validation (to ensure data is reasonable)
- examples include range checks, type checks, length checks, ...
- verification (checks if data input matches original/if transmitted data matches original)
- can use double data entry or visual check/other methods such as parity checks
- doesn't check whether or not data is reasonable [3]

- (ii) **one mark** for each way of maintaining data integrity + **one mark** for an example/enhancement

- parity checking
- one of the bits is reserved as parity bit
- e.g. 1 0 1 1 0 1 1 0 uses odd parity
- number of 1s must be odd
- parity is checked at receiver's end
- a change in parity indicates data corruption
- check sum
- adds up bytes in data being sent and sends check sum with the data
- calculation is re-done at receiver's end
- if not the same sum then the data has been corrupted during transmission [3]

Answer 17

(a) One mark for validation, one mark for verification.

validation

- check whether data is reasonable / meets given criteria

verification

- method to ensure data which is copied / transferred is the same as the original
- entering data twice and computer checks both sets of data
- check entered data against original document / source

[2]

(b) any four from:

- parity can be even or odd
- parity check uses the number of 1s in a binary pattern
- if there is an even / odd number of 1s, then the parity is even / odd
- following transmission ...
- parity of each byte checked
- a parity bit is used to make sure binary pattern has correct parity
- example: 1 0 0 1 0 1 1 has parity bit set to 1 in MSB since system uses odd parity (original data: 0 0 1 0 1 1 1 which has four 1 bits)

[4]

Answer 18

(a) any two from:

- malicious code / software / program
- that replicates / copies itself
- can cause loss of data / corruption of data on the computer
- can cause computer to "crash" / run slowly
- can fill up hard disk with data

[2]

(b) any two from:

- checks for boot sector viruses when machine is first turned on
- when an external storage device is connected
- checks a file / web page when it is accessed / downloaded

[2]

Answer 19

(Not Available)

Answer 20

(a) Data transmitted in both directions BUT only 1 direction at a time [1]

(b) (i) 1 1 0 1 0 0 0 1 [1]

(ii) Any **two** points from:

- computer "B" counts number of 1-bits
- if number of 1-bits is even then byte has been transmitted correctly
- if number of 1-bits is odd then byte has been corrupted during transmission [2]

(c) 1 0 1 1 0 1 1 1

0 1 1 1 1 0 0 0

————→ 0 0 0 1 1 0 1 0

0 1 1 1 0 0 0 1

1 0 1 0 1 1 0 0

(i) (see diagram above). 1 mark for identifying third byte and 1 mark for identifying 5th bit as an error [2]

(ii) corrected byte

0	0	0	1	0	0	1	0
---	---	---	---	---	---	---	---

[1]

(iii) Any **two** from:

- for example, a check sum
- brief description of check sum
- description of alternative checking method
- ask for data to be re-sent [2]

Answer 21

(a) – a program that can self-replicate
can delete or corrupt data from a computer system
malicious code often installed without the user's knowledge [1]

(b) Any **three** from:

- install and run/use anti-virus software
- update anti-virus software on a regular basis
- avoid programs/software/downloads from unknown sources
- never "double click" on email attachments which are executable i.e. contain .exe, .com or .vbs
- install and run/use a firewall (which screens incoming Internet and network traffic)
- install and run/use anti-spyware software (which works in conjunction with the anti-virus to stop viruses doing any harm to the computer)
- avoid suspicious web sites
- delete emails from unknown contacts without opening
- avoid using media from unknown sources [3]

Answer 22

(b) (i)

letter	bytes adjusted for even parity							
C	1	1	0	0	0	0	1	1
O	1	1	0	0	1	1	1	1
M	0	1	0	0	1	1	0	1
P	0	1	0	1	0	0	0	0
U	0	1	0	1	0	1	0	1
T	1	1	0	1	1	0	0	0
I	1	1	0	0	1	0	0	1
N	0	1	0	0	1	1	1	0
G	0	1	0	0	0	1	1	1

(-1 mark for each error in the first column)

[2]

(ii) 0 1 0 1 1 1 0 0

[1]

(iii) Any **three** points from:

character "P" flagged as having *odd parity* (row 4 in diagram)
 parity byte sent with data i.e. 0 1 0 1 1 1 0 0
 column 5 also has *odd parity* (or equivalent)
 faulty bit must be in row 4 and column 5
 idea of auto correction of fault (in row 4, column 5)

(Check if diagram has been annotated to show faulty bit)

[3]

Answer 23

(a) (i) character "A"

[1]

(ii) column number: 6
 row number: 8

[1]

(iii) Any **three** points from:

character "A" is showing *even parity*
 column 6 is also showing *even parity*
 where the column and row intersect is position (6, 8)
 the bit value here should be 0 and not 1

[3]

(b) Any **three** points from:

bytes sent as a block
 bytes added up before transmission
 result of addition is sent with the data block
 same calculation is carried out at receivers end
 the two values are compared

[3]

Answer 24

(a) One point from each:

verification

- this is a way of preventing errors when data are copied from one medium to another
- e.g. double entry or visual checks on data
- verification does not check to see if data makes sense or are within acceptable boundaries;
- it only checks to see if original and copied data match exactly

validation

- this is a computer check on input data
- see if data matches certain criteria and are reasonable
- example e.g. range check

[2]

(b) (i) length check

[1]

(ii) range check

[1]

(c) (i) **5 4 3 2 1**
3 0 4 5 ?

$$\begin{aligned}\text{sum} &= (5 \times 3) + (4 \times 0) + (3 \times 4) + (2 \times 5) \\ &= 15 + 0 + 12 + 10 = 37 \\ &\text{divide 37 by 11 and get 3 remainder 4}\end{aligned}$$

check digit is 4

(1 mark for a reasonable calculation + 1 mark for correct check digit allow follow through)
[2]

(ii) Any **two** points from:

- check digit for 34921 re-calculated
- check digit value should be 7 (using modulo 11)
- error will be flagged check digit is shown as 1 in transmitted number

[2]