

1.6.2 Data integrity

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1.6.2 Data integrity

Computer Science 9608 Topical Past Papers



Topic: 1.6.2 Data Integrity

May/June 2003.P1

7. (b) When data is transmitted it is subject to corruption. Explain how a parity check could be used to determine whether corruption has taken place. [4]

A college stores its student files on paper which is kept in filing cabinets. The decision is taken to computerise these student files.

A systems analyst is employed to supervise the process.

11. The data stored needs to be as accurate as possible. Twice each year examination grades are entered (A to G) for each subject. Describe how the techniques of

- (i) verification,
- (ii) validation

are used to ensure that the stored data is as accurate as possible. [6]

Oct/NOV 2004. P1

9. Customers are identified by a 6 digit code. The first three digits are between 000 and 100 for organisations and between 300 and 600 for individuals. It is important that the 6 digit customer code is correctly entered to the system.

Describe how

- (i) verification
- (ii) validation

can help to ensure that as few errors as possible occur. [6]

Oct/NOV 2005. P1

5. (a) Errors can occur when data is transmitted from one device to another. Explain how a checksum can be used to monitor a transmission for errors. [3]

May/June 2006. P1

A small business has one shop. It specialises in taking portrait photographs for customers.

Details of customers are stored on paper.

It is decided to buy a stand-alone computer and use it to store customer records in a file.

8. Data that is entered into the file needs to be verified and validated.



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**Topic: 1.6.2 Data Integrity**

- (a) Explain what is meant by the terms
(i) verification;
(ii) validation. [2]
- (b) Describe two methods that can be used for validating the date of the original commission. [4]

Oct/NOV 2006. P1

Authors send books to a publishing company. At this stage books are text documents with any illustrations being added at the end of the publishing process.

7. The communications system used by the company uses circuit switching for the transmission of data between head office and the copywriters.

(b) (ii) During transmission data can be corrupted. Check sums and parity checks can be carried out on the data.

Explain how check sums and parity checks are used to detect transmission errors. [4]

May/June 2007

5. (a) Describe what is meant by verification of data. [2]

(b) Give an example of an application which would require the data input to be verified and explain why it would be necessary. [2]

Oct/NOV 2007

11. The data which is transmitted between survey sites and head office is liable to errors. Data which is received is checked for errors.

- (a) One method of checking for errors is to use parity checks.

The following four bytes have been received:

01101001 10111100 10101010 00100100

- (i) One of the bytes contains an error. State which byte. [1]
(ii) Explain your choice of answer in (i). [2]
(iii) Explain why a byte may still be in error even if it passes the parity test. [1]

- (b) A second method of checking for errors is to use check sums.

Explain how check sums are used to check data for transmission errors. [4]

May/June 2009

6 (b) In a certain computer system parity checking is used to check that data has been transferred correctly. The type of parity checking used is even parity.

Using the byte 01101001 as an example:

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- (i) explain what is meant by an even parity check, [2]
(ii) Give an example of an error which would not be detected. [1]

A company specialises in creating websites for customers.

12. The company stores details of customers and their accounts in a database.

The data input to the database must be verified and validated.

One piece of data which will be input to the database is the amount of money when a customer makes a payment.

(b) (i) State what is meant by verification of data. [1]

(ii) Describe how the customer payment will be verified when it is input to the database. [2]

The data input to the database must be verified and validated.

One piece of data which will be input to the database is the amount of money when a customer makes a payment.

(c) (i) State what is meant by validation of data. [1]

(ii) Describe how the customer payment will be validated when it is input to the database. [2]

Oct/NOV 2009. P12

3. A library stores details of members on the member file.

(b) When a member's name is input to the system it needs to be validated.

(i) State what is meant by validation. [1]

(ii) Describe two validation checks that can be carried out when a member's name is input to the system. [4]

Oct/NOV 2010. P11

6. (c) When data is transmitted around a network it is possible that the data becomes corrupted.

Explain how parity checking can be used to detect such transmission errors. [4]

A factory production line produces parts for a car manufacturer. The management of the factory decide to computerise the production line.

A systems analyst is employed to oversee the computerisation.

9. When a piece of metal is sent to one of the machines its length must be measured.

(a) Describe how the length of the piece of metal can be automatically measured by the system. [2]



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(b) (i) Describe a validation check which can be done on the measurement. [2]

(ii) The operator inputs the required length of the finished piece.

Describe two ways that this length can be verified. [4]

Oct/NOV 2010. P12

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(ii) The operator inputs the required length of the finished piece.

Describe two ways that this length can be verified. [4]

Oct/NOV 2010. P13

6. (c) When data is transmitted around a network it is possible that the data becomes corrupted.

May/June 2011. P11

8 (c) The following bytes were received during a data transmission.

01101101 10101010 10111101 10110001

Parity is being used as an error check.

State which one of the bytes has been corrupted. Explain why you chose the one that you did.

[3]

May/June 2011. P12

8. (c) The following bytes were received during a data transmission.

01101101 10101010 10111101 10110001



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Parity is being used as an error check.

State which one of the bytes has been corrupted. Explain why you chose the one that you did.

[3]

May/June 2011. P13

8. (c) The following bytes were sent during a data transmission.

01101100 10101010 10110001

Explain how a check sum can be used to check whether or not the bytes have been corrupted during transmission.

[3]

Oct/NOV 2011. P12

8 A building firm has a main office with stand-alone computers for the workers to use.

It is decided to link these stand-alone computers to make a network.

(b) When data is passed around a network it can be corrupted.

Explain how check sums can be used to detect errors in transmitted data.

[4]

Oct/NOV 2011. P13

8 A factory specialises in making components for cars.

The offices of the factory have a number of stand-alone computers. The decision is taken to link these machines in a network.

(b) When data is transmitted around a network it can be corrupted.

Explain, giving examples, how parity can be used to detect errors in transmitted data.

[4]

May/June 2012. P13

8 (b) When data is transmitted it may become corrupted.

- (i) Explain how a parity check can be used to detect a possible error in a transmitted byte. [3]
- (ii) Describe how parity can be used to identify and correct the single error in this transmitted data block:

0 1 1 0 1 1 0 1

1 0 0 1 0 1 1 1

0 1 0 1 0 1 0 0



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1 0 0 0 1 0 0 1

0 1 1 0 0 0 1 1

1 0 0 0 0 1 1 0

0 1 1 0 1 1 0 1

0 1 0 0 0 0 0 Parity Byte

[3]

Oct/NOV 2012. P11

9 (c) When data is transmitted between devices it can be corrupted. One method to detect corruption is the use of parity.

Explain how parity can be used to detect the presence of errors in a transmission.

[4]

Oct/NOV 2012. P12

9. (c) When data is transmitted between devices it can be corrupted. One method to detect corruption is the use of echoing.

Explain how echoing can be used to detect the presence and correction of transmission.

[4]

Oct/NOV 2012. P13

9 (c) When data is transmitted between devices it can be corrupted. One method to detect corruption is the use of a checksum.

Explain how a checksum can be used to detect the presence of errors in a transmission.

[4]

May/June 2013. P11/P12

3 (b) The word C O M P U T I N G is to be transmitted as nine bytes of data. Each character in the word has an ASCII value.

The system uses even parity and the left most bit is added to make each byte even parity.



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- (i) Complete the codes so that they all have even parity.

C		1	0	0	0	0	1	1
---	--	---	---	---	---	---	---	---

O	1	0	0	1	1	1	1
M	1	0	0	1	1	0	1
P	1	0	1	0	0	0	0
U	1	0	1	0	1	0	1
T	1	0	1	1	0	0	0
I	1	0	0	1	0	0	1
N	1	0	0	1	1	1	0
G	1	0	0	0	1	1	1

[2]

(ii) Fill in the parity byte in the final row in the table above.

[1]

(iii) The character 'P' is received incorrectly as 0 1 0 1 1 0 0 0

Describe how horizontal and vertical parity checking would be used to detect the erroneous bit.

[3]

May/June 2013. P13

8 The term **LOGIC GATES** is to be transmitted as 12 bytes of data.

Each character in the term has an ASCII value. The system is using odd parity and the left-most bit is used as the parity bit. An additional parity byte is also sent after the term.

The following bytes arrived at their destination:

	1	2	3	4	5	6	7	8	
	letters								bytes received
1	L	0	1	0	0	1	1	0	0
2	O	0	1	0	0	1	1	1	1
3	G	1	1	0	0	0	1	1	1
4	I	0	1	0	0	1	0	0	1
5	C	0	1	0	0	0	0	1	1
6	<Space>	0	0	1	1	0	0	1	0
7	G	1	1	0	0	0	1	1	1
8	A	1	1	0	0	0	1	0	1
9	T	0	1	0	1	1	0	0	0
10	E	0	1	0	0	0	1	0	1
11	S	0	1	0	1	0	1	1	1
12	parity byte	0	1	0	0	1	1	1	1



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(a) One of the bytes has an error after transmission.

- (i) Locate which character contains the error.
- (ii) Indicate which bit has been transmitted incorrectly.
- (iii) Explain how you arrived at your conclusion.

[1]

[1]

[3]

(b) The following bytes were sent during a data transmission:

0 0 1 1 0 0 0 1

1 0 0 1 1 0 1 1

1 1 1 0 0 0 0 0

Explain how a checksum is used to check whether the bytes have been corrupted during data transmission.

[3]

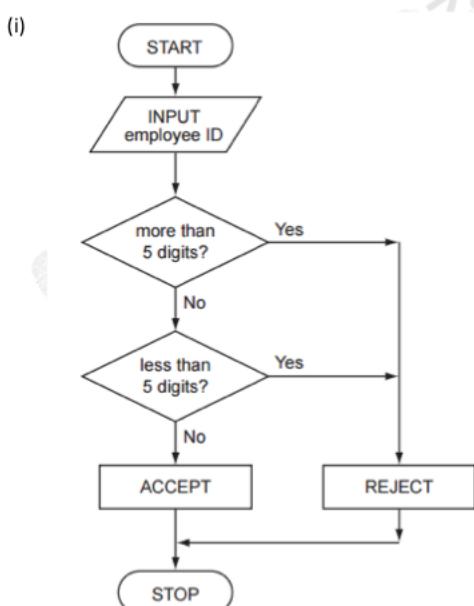
Oct/Nov 2013. P11

3 (a) Describe the difference between verification and validation of data.

[2]

(b) Two different validation checks are described using each of the following flowcharts.

Name the types of validation check.

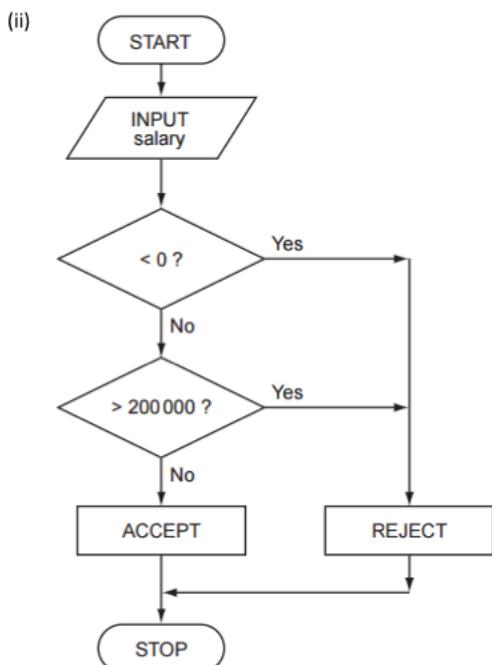


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Type of validation check [1]



Type of validation check [1]

(c) Check digits are another validation method. The modulo-11 method multiplies each digit by its digit position, adds the totals together and divides the result by eleven. The remainder is the check digit.

Note: the check digit is digit position 1.

- (i) Calculate the check digit (_) for the following number:

3 0 4 5 _

Show your working.

[2]

- (ii) The employee ID **39421** was entered into the computer as **34921**.

Explain how the check digit validation check will flag **34921** as an invalid employee ID.

[2]

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4 A format check is a type of validation for an input string. A format check can be implemented using an input mask. An input mask consists of a string of characters which indicate the type of character allowed in each character position.

A software application uses the following codes for specifying an input mask

Character	Meaning
0	a digit must be present
9	a digit may be present
T	a letter must be present
t	a letter may be present

✓
✓

(a) The following input mask is used on each of the data items in the table below:

T	T	9	0	0	T	T
---	---	---	---	---	---	---

Which of the following data items would pass or fail the format validation check?

Put a tick in the appropriate column:

Data item	Pass	Fail
K X 2 3 7 N		✓
N A 8 3 K K	✓	
W 4 4 6 P Q		✓
C 2 4 3 3 Q		✓
R 4 9 N L		✓

[5]

(b) A car registration in country X has the following format:

1 letter - followed by 1, 2 or 3 digits - followed by 3 letters

(i) For this car registration format, give a suitable input mask:

[3]

--	--	--	--	--	--	--

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(ii) Give one example of a car registration that would pass using your input mask:

[1]

--	--	--	--	--	--	--

(iii) Give one example of a car registration that would fail using your input mask:

[1]

--	--	--	--	--	--	--

9 A vending machine dispenses drinks and has a number of drinks options.

drink	option with code							
tea	black	10	+ milk	11	+ sugar	12	+ milk + sugar	13
coffee	black	20	+ milk	21	+ sugar	22	+ milk + sugar	23
cappuccino	normal	30	+ extra milk	31	+ sugar	32	+ extra milk + sugar	33
chocolate	normal	40	+ extra milk	41	+ sugar	42	+ extra milk + sugar	43
cold drinks	coke	50	orange	51	lemon	52	mango	53
water	normal	60	cold	61	cold fizzy	62	hot	63

The vending machine is controlled by a microprocessor.

If a customer keys in 23 then they will receive a cup of coffee with milk and sugar.

A selected code is stored in a 7-bit register:

16 4 2 1

So 23 will be stored as

B 0 0 1 0 1 1 1

If an invalid code is keyed in, an error message is displayed.

(d) This system uses even parity. An extra eighth (8th) bit is used as the parity bit.

Give the parity bit values in parts (b) and (c) needed to achieve even parity.

[2]



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(e) The vending machine is connected to a central computer through a dedicated communications line.

Every selection is stored. When eight drinks have been dispensed, these eight codes are transmitted to the computer.

(ii) The vending machine transmits eight codes (bytes), followed by a parity byte. The following bytes have been received by the computer:

1 0 0 0 1 0 1 1

1 0 0 0 1 1 0 1

0 0 1 1 0 1 0 1

0 0 0 1 0 1 1 1

0 1 0 0 1 0 0 0

01001000
 10101010
 00111011
 10100000

 01010101 ← Parity Byte

One of the eight bytes of data contains an error that occurred during data transmission.

Using an arrow, identify the byte where the error has occurred.

Circle the bit that has been altered.

Explain your reason for choosing the byte and bit identified above. [3]

May/June 2014. P13

5 A company issues a plastic card security pass to each of its workers. The pass consists of a photograph and a 10-digit security number stored on a magnetic stripe.

(a) (ii) Name and describe two validation checks that could be carried out on the 10-digit security number. [2]

(b) A card was recently stolen and a new photograph attached to the card.

Describe what additional security measures could be implemented to prevent this card allowing entry at the gate. [2]



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7 (b) A computer system uses even parity. The leftmost position of each byte is the parity bit.

(i) Complete the byte below:

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

[1]

(ii) The parity bit is used to perform a parity check when a byte is transmitted from computer A to computer B. Explain how computer B will establish whether or not the byte has been transmitted correctly. [2]

(c) In addition to a parity bit check on a byte, a parity block check is also carried out. Computer A transmits four bytes followed by a parity byte. The following sequence of bytes has just been received by computer B.

10110111
 01111000
 00011010
 01110001

 10101100

One of the four bytes has an error in one of the bits.

(i) Identify the byte where the error has occurred with an arrow.

Circle the bit that has been altered.

[2]

(ii) Write down the corrected byte:

--	--	--	--	--	--	--

(iii) Explain what the computer system needs to do if more than 1 bit has been transmitted wrongly. [2]

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May/June 2015. P11

6 The following logic circuit is used to monitor part of a chemical process. A, B and C are binary values input to the logic circuit from the chemical process.

X is the binary value output from the logic circuit.

(d) Even parity is used to check whether any errors occurred during transmission.

The table below shows the first ten byte samples received by the central computer. An extra byte (the parity byte) is sent after each block of ten bytes.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
byte 1	0	1	0	0	0	1	1	1
byte 2	1	1	1	0	0	1	1	1
byte 3	0	0	0	0	1	1	0	0
byte 4	1	1	1	0	0	1	0	0
byte 5	1	0	0	1	1	0	1	0
byte 6	1	1	0	0	0	0	1	1
byte 7	1	1	1	1	0	0	0	1
byte 8	0	1	1	0	1	1	0	0
byte 9	1	0	0	0	0	0	0	1
byte 10	0	0	0	1	1	1	1	0
parity byte	0	0	0	1	0	1	1	1

One of the received bytes contains a single error.

- (i) Identify the byte that contains the incorrect bit. ✓ [1]
(ii) Identify the bit position that contains the incorrect bit. ✓ [1]
(iii) Explain why, when using this parity block system, that there is no need for the incorrect byte to be re-transmitted. [2]

7 (a) A website sells products using an online order form.

A user enters their:

- date of birth (DD/MM/YYYY) *format*
- credit card number (16 digits) *length*
- telephone number *Type*
- postal address *prefix*

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- email address

- (i) Three of the items above undergo a validation check. ✓
 Identify the three items that can be validated.
 Give a suitable validation check. Each should be different.
- (ii) Name the method where data are entered twice for checking purposes.
 Name the item which will undergo this method.
 Give a reason for your choice.

[3]

double entry

[3]

May/June 2015. P13

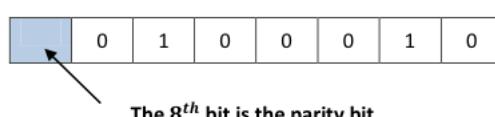
6 A satellite television receiver has a number of channels:

Category	Channels
News	10 to 19
Film	20 to 29
Plays and documentaries	30 to 39
Sport	40 to 49
Comedy	50 to 59
Special interest	60 to 69
Motoring and leisure	70 to 79

✓ A user keys in a choice of channel using a handset.

The handset and the receiver are each controlled by a microprocessor.

When a user keys in 34, this value is stored in an 8-bit register as shown below:



(a) A user keys in 47.

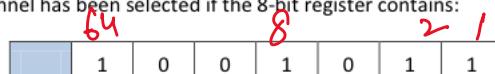
Show the value stored in the 8-bit register.



[1]

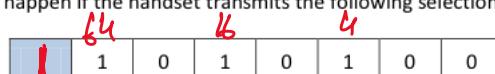
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(b) Calculate which channel has been selected if the 8-bit register contains:



[1]

(c) Describe what could happen if the handset transmits the following selection:



(d) Even parity is used when the handset transmits data to the receiver. Give the parity bit that is required in the 8-bit register in part (c).

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9 (a) Give a brief description of each of the following terms:

Validation

Verification

[2]

(b) Data are to be transferred between two devices. Parity checks are carried out on the data.

Explain what is meant by a parity check. Give an example to illustrate your answer.

[4]

Oct/Nov 2015. P12

8 (a) The string of characters, "BINARY CODE", was transmitted using 11 bytes of data. An additional byte, called the parity byte, was also transmitted.

Parity bytes can be used to identify exactly which bit has been transmitted incorrectly.

The table shows bit patterns for all 12 bytes after transmission. Even parity was used and the first bit is the parity bit.



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	character	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8
byte 1	B	0	1	0	0	0	0	1	0
byte 2	I	1	1	0	0	1	0	0	1
byte 3	N	0	1	0	0	1	1	1	0
byte 4	A	0	1	0	0	0	0	0	1
byte 5	R	1	1	0	1	0	0	1	0
byte 6	Y	0	1	1	1	1	0	0	1
byte 7		1	0	1	0	0	0	0	0
byte 8	C	1	1	0	0	0	0	1	1
byte 9	O	1	1	0	0	1	1	1	1
byte 10	D	0	1	0	0	0	1	0	0
byte 11	E	1	1	0	0	0	1	0	1
parity byte		0	0	1	0	0	0	1	0

- (i) There is one error in the transmission. Indicate the byte number and bit number of the bit which has been incorrectly transmitted. [2]
- (ii) Explain your answer to part (i). [2]

(b) Verification and validation can be applied during data entry.

Describe what is meant by these terms. For each method, explain why it is needed.

Verification

Validation

[4]

7 A small company produces scientific magazines. The owner buys some new desktop computers. The computers are used to store thousands of colour images (diagrams and photographs). All the computers have Internet access.

(c) Employees using the new computers receive training. At the end of the training, each employee completes a series of questions.

Three answers given by an employee are shown below.

Explain why each answer is incorrect.

(ii) "Data validation is used to make sure that data keyed in are the same as the original data supplied.".

[2]

6 Parity bits can be used to verify data.

(a) The following binary number is transmitted using **even** parity.



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Add the missing parity bit.

Parity bit	0	1	0	1	1	0	1	0

(b) In the following parity block, the first column contains the parity bits, and the last row contains the parity byte. A device transmits the data using **even** parity.

(i) Circle the error in the data transmitted.

Parity bit	Data							
	1	1	0	1	0	1	1	1
1	1	0	0	0	1	1	1	0
0	1	0	0	1	0	1	1	1
1	1	1	0	1	1	1	1	1
Parity byte	1	1	1	1	1	0	0	1

(ii) Explain how you identified the error.



[1]

[2]

(c) The data received can contain errors that are not detected using parity bits.

Explain how this can happen.

[2]

(d) Parity is not the only method to verify the data has been sent correctly.

Name and describe one other method of data verification during data transfer.

[3]



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