1.1.3 Data storage

Wednesday, 17 February 2021   7:48 PM

1.1.3 Data
storage

Topic: 1.1.3 Data storage

Oct/Nov 2015. P12

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Computer term	Description	
Interface	Reduction of file size by permanently removing some redundant information from the file	*Lossy Compression*
Interrupt	File compression format designed to make photo files smaller in size for storage and for transmission	*JPEG*
JPEG	File compression system for music which does not noticeably affect the quality of the sound	*MP3*
Lossless compression	Hardware component that allows the user to communicate with a computer or operating system	*Interface.*
Lossy compression	The file is reduced in size for transmission and storage; it is then put back together again later producing a file identical to the original	*Lossless Compression.*
MIDI	Signal sent to a processor which may cause a break in execution of the current routine, according to priorities	*Interrupt.*
MP3 format	Standard adopted by the electronic music industry for controlling devices such as synthesisers and sound cards	*MIDI*

[6]

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5 A security system uses sensors, a camera and a microprocessor to capture images of each person entering a large shopping mall.
(b) Each image taken requires 1 MB of storage. If the camera captures an image every 5 seconds over a 24 hour period, how much storage is required?
Give your answer in **gigabytes** and show all your working.   [2]

7 (a) Check digits are used to ensure the accuracy of input data.
A 7-digit code number has an extra digit on the right, called the check digit.

Digit position	1	2	3	4	5	6	7	8
Digit	–	–	–	–	–	–	–	–

Check Digit

The check digit is calculated as follows:
- each digit in the number is multiplied by its digit position
- the seven results are then added together
- this total is divided by 11
- the remainder gives the check digit (if the remainder = 10, the check digit is X)

(i) Calculate the check digit for the following code number. Show all your working.

4 2 4 1 5 0 8 *6*   [2]

(ii) An operator has just keyed in the following code number:

3 2 4 0 0 4 5 X

Has the operator correctly keyed in the code number?
Give a reason for your answer.   [3]

(b) When data are transmitted from one device to another, a parity check is often carried out on

Data Integrity.

Verification: Checking of received data against source.
Validation: Check (Programmatic) against the data entry.
Range Age : 15—20

CNIC 52503-3559645—1

each byte of data. The parity bit is often the leftmost bit in the byte.

(i) If a system uses even parity, give the parity bit for each of the following bytes:

parity bit							
1	1	0	0	1	1	0	

parity bit							
0	0	0	0	0	0	1	

(handwritten: b ÷x, 8b=1B, 1024B=1KB, 1024KB=1MB)

(handwritten: 11)78, 77, 1 → 7)

[2]

(ii) A parity check can often detect corruption of a byte.
Describe a situation in which it **cannot** detect corruption of a byte. [1]

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5 A security system records video footage. One minute of video requires 180 MB of storage. The recording system can store several hours of video footage.
(b) Calculate how much storage would be needed for 2 hours of video footage. *(handwritten: 180 mB/min)*
Show your working and give the answer in Gigabytes (GB). [2]

(handwritten: 21.6 GB, 180×120 = 21600 mB / 1024)

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9 MP3 file compression reduces the size of a music file by 90%.
(a) A music track is 80 MB in size. *(handwritten: 8MB)*
Calculate the file size after compression.
How many MP3 files of the size calculated above could be stored on an 800 MB CD? *(handwritten: 100)* [2]
(b) (i) Explain how MP3 files retain most of the original music quality. [2]
(ii) State the type of file compression used in MP3 files. *(handwritten: Lossy)* [1]
(iii) Name another file compression format. [1]

(handwritten: 8, By using perceptual music shaping, MP4, JPEG, MP3)

9 Check digits are used to ensure the accuracy of entered data.

A 7-digit number has an extra digit on the right, called the check digit.

digit position:	1	2	3	4	5	6	7	8
digit:	–	–	–	–	–	–	–	–

↑ check digit

The check digit is calculated as follows:

- each digit in the number is multiplied by its digit position
- the seven results are then added together
- this total is divided by 11
- the remainder gives the check digit (if the remainder = 10, the check digit is X)

(a) Calculate the check digit for the following number. Show all your working.

4   2   4   1   5   0   8   ... [2]

(b) An operator has just keyed in the following number:

3 2 4 0 0 4 5 X

Circle below **correct** if the check digit is correct **OR incorrect** if the check digit is incorrect.

correct   incorrect

Explain your answer. [3]

4 Nigel wants to send a large text file electronically to Mashuda.
(a) Describe how the size of the text file can be reduced. [3]
(b) This file will be transmitted to Mashuda as an email attachment. Mashuda then stores it on her computer.
Explain how checksums can be used to verify that the file has not been corrupted during transmission or data storage. [4]

(handwritten diagram: data block → sum → calculate =)

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8 Identify whether the **four** statements about file compression are correct by writing TRUE or FALSE in the following table.

Statement	TRUE or FALSE
MIDI files store the actual music notes in a compressed format	FALSE
JPEG files are examples of lossless file compression	FALSE
MP3 files are, on average, 90% smaller than the music files stored on a CD	TRUE
MP4 files are examples of lossy file compression	

(Right margin handwritten notes:)

Errors: Digit
1. Skip
2. Swap (Transposition)
3. Unnecessary digit

3 DIV

5)16
15
1 MOD

16/5 = 3.2
16 MOD 5 = 1
16 DIV 5 = 3

MP4 files are examples of lossy file compression   TRUE   [4]

10
(b) The current status of the engine is sent to a computer in the aeroplane.
Each piece of data collected is 8 bytes in size. Data collection occurs every 30 seconds.
Calculate the number of kilobytes that would be needed to store the data collected during a 10-hour flight. Show
your working.   [3]

120 Collection/hour
1200 Collection/10 hour
1200×8 = 9600 Bytes

3 Steffi has a number of files of different sizes that contain her work.
Tick to show whether each statement is **true** or **false**.

9600/1024 = 9.375 KB

Statement	true (✓)	false (✓)
47KB is larger than 10MB.		✓
250bytes is smaller than 0.5MB.	✓	
50GB is larger than 100MB.	✓	
1TB is smaller than 4GB.		✓

[4]

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5 (a) Parity checks are often used to detect errors that may occur during data transmission.
The received bytes in the table below were transmitted using **odd parity**.

Tick to show whether each byte has been **corrupted during transmission** or **not corrupted during transmission**.

Received byte	corrupted during transmission (✓)	not corrupted during transmission (✓)
10110100		
01101101		
10000001		

(b) Another method of error detection is Automatic Repeat reQuest (ARQ).
Explain how ARQ is used in error detection.   [4]

13 (a) Gurdeep wants to send a large file to Jennifer over the Internet.
State **two** benefits of compressing the file to send it.   [2]

To Save on time
" " " Storage

(b) Two types of compression are lossy and lossless.
Choose the most suitable type of compression for the following and explain your choice.
(i) Downloading the code for a computer program: *Lossless*   [3]
(ii) Streaming a video file: *Lossy.*   [3]

4 There are various methods used to detect errors that can occur during data transmission and
storage.
Describe each of the following error detection methods.

Parity check
Check digit
Checksum
Automatic Repeat request (ARQ)   [8]

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2 Data files are stored in different file formats.
Complete the table by providing a suitable file format for each file type. The first one has been

Complete the table by providing a suitable file format for each file type. The first one has been done for you.

File type	File format
Pictures	.JPEG
Text	.txt
Sound	.MP3
Video	.MP4

[3]

9 (b) Kamil wants to store a 16-bit colour image file. The image size is 1000 pixels. Calculate the size of the file.
Give your answer in **bytes**. Show your working.

2B

1000B x 2 = 2000B

[2]

(c) Describe the differences between primary and secondary storage. ?? [4]

May/June 2018. P11

4 Michele wants to email a file to Elsa. The file is too large so it must be compressed.
(a) Name **two** types of compression that Michele could use. [2]

(b) The file Michele is sending contains the source code for a large computer program.
Identify which type of compression would be most suitable for Michele to use.
Explain your choice. [4]

May/June 2018. P12

2 (a) Nancy has captured images of her holiday with her camera. The captured images are stored as digital photo files on her camera.
Explain how the captured images are converted to digital photo files. [4]

(b) Nancy wants to email the photos to Nadia.
Many of the photos are very large files, so Nancy needs to reduce their file size as much as possible.
Identify which type of compression would be most suitable for Nancy to use. Explain your choice.

Lossy

[4]

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5 The three binary numbers in the registers X, Y and Z have been transmitted from one computer to another.

								Parity bit
Register X	1	0	0	1	0	0	1	0
Register Y	1	1	1	0	0	1	1	1
Register Z	1	1	1	0	1	0	0	1

Only **one** binary number has been transmitted correctly. This is identified through the use of a parity bit.
Identify which register contains the binary number that has been transmitted **correctly**. Explain the reason for your choice.
The binary number that has been transmitted correctly is in **Register** ....
Explanation ....

Oct/Nov 2018. P12

1 Computers use a character set to convert text into binary.
One character set that can be used is ASCII.
Each letter in ASCII can also be represented as a denary value.
(a) The word BUS has the denary values:

B	U	S
66	85	83

Convert the denary values into 8-bit binary.

66 [ ][ ][ ][ ][ ][ ][ ][ ]

85 [ ][ ][ ][ ][ ][ ][ ][ ]

83 [ ][ ][ ][ ][ ][ ][ ][ ]

[3]

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(b) Each letter in ASCII can also be represented as a hexadecimal value.
The word KEY has the 8-bit binary values:

K	E	Y
01001011	01000101	01011001

(i) Convert the three 8-bit binary values into hexadecimal.

01001011 ....

01000101 ....

01011001 ....

[3]

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Oct/Nov 2018 P13 (2210)

2
Parity checks and Automatic Repeat reQuests (ARQ) can be used to check for errors during data transmission and storage.

(a) A system uses **even parity**. Write the appropriate parity bit for each byte.

Parity Bit							
	1	0	1	0	0	1	1
	1	0	1	1	1	1	1
	1	0	1	0	0	0	1

[2]

(b) Explain how Automatic Repeat reQuests (ARQ) are used in data transmission and storage.

....

....

....

....[2]

(c) State **one** other method that could be used to check for transmission errors.

....[1]

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7 (c)
David needs to send a large section of the programming code as an email attachment.

He uses lossless compression to reduce the file size.

Explain how the file size is reduced.

....

....

....

....

....

....[3]

Oct/Nov 2018 P13 (2210)

12
Explain the difference between a Musical Instrument Digital Interface (MIDI) file and a MP3 file.

....

MIDI	MP3
Saves text	Save Sound
Uncompressed	Compressed Lossy (90%)
Played by synthesisers	Played by computer
Small Size files	Large Size file

....[4]

18-2-21