1.4 System Software: Test Pack

OCR J277 · Calculators not allowed · about 25 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State two functions that are carried out by the operating system of a computer.

(Total for Question 1 is 2 marks)

2 Describe the purpose of a directory (folder) structure as part of an operating system's file management.

(Total for Question 2 is 2 marks)

3 Explain what is meant by an interrupt, and explain why interrupts are assigned different priority levels.

(Total for Question 3 is 3 marks)

4 A 20 MB video file is compressed using lossy compression to a compression ratio of 5:1. Calculate the size of the compressed file, in MB.

(Total for Question 4 is 3 marks)

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5 The pseudocode below, written in the OCR Exam Reference Language, simulates round robin scheduling of three tasks sharing a processor, with a fixed time slice of 2:

```
array tasks[3]
tasks[0] = 6
tasks[1] = 3
tasks[2] = 5
timeSlice = 2
round = 0
while tasks[0] > 0 OR tasks[1] > 0 OR tasks[2] > 0
round = round + 1
for i = 0 to 2
if tasks[i] > 0 then
if tasks[i] ≥ timeSlice then
tasks[i] = tasks[i] - timeSlice
else
tasks[i] = 0
endif
endif
next i
  print(str(round) + ": " + str(tasks[0]) + ", " + str(tasks[1]) + ", " + str(tasks[2]))
endwhile
```

Round	tasks[0]	tasks[1]	tasks[2]
1			
2			
3			

(a) Complete the trace table below by tracing this algorithm. **(3)**

Round	tasks[0]	tasks[1]	tasks[2]
1	?	?	?
2	?	?	?
3	?	?	?

(b) State after how many rounds all three tasks have finished, and explain how you can tell this from the WHILE loop's condition. **(3)**

(Total for Question 5 is 6 marks)

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6 The pseudocode below simulates a simplified FIFO page replacement policy for a system with 3 physical memory frames. When a referenced page is not already held in one of the frames (a page fault), the oldest page is removed and the new page is added:

```
frames <- ["-", "-", "-"]
pageRefs <- [1, 2, 3, 1, 4, 1]
FOR i <- 1 TO 6
  page <- pageRefs[i]
  IF page NOT IN frames THEN
    FOR j <- 1 TO 2
      frames[j] <- frames[j + 1]
    NEXT j
    frames[3] <- page
  ENDIF
  OUTPUT i, frames[1], frames[2], frames[3]
NEXT i
```

i	frames[1]	frames[2]	frames[3]
1			
2			
3			
4			
5			
6	**3**	**4**	**1**

Row 6 has been completed for you - complete rows 1-5

(a) Complete the trace table for i = 1 to 5. Row 6 has been completed for you. **(5)**

i	frames[1]	frames[2]	frames[3]
1	?	?	?
2	?	?	?
3	?	?	?
4	?	?	?
5	?	?	?
6	3	4	1

(Total for Question 6 is 5 marks)

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Mark scheme · 1.4 System Software: Test Pack

Question 1

any one valid function, e.g. memory management oe **B1**

any second, different valid function, e.g. multitasking / peripheral management (device drivers) / user management / file management / providing the user interface oe **B1**

Answer: Any two from: memory management; multitasking; peripheral management (via device drivers); user management; file management; providing the user interface.

Question 2

allows files to be organised/grouped in a hierarchical/logical structure of folders and sub-folders oe **B1**

makes it easier for the user to find, access and manage files, rather than every file being stored in one place oe **B1**

Answer: A directory structure lets the operating system organise files into folders and sub-folders in a logical, hierarchical way, making it easier for users to find, access and manage their files rather than storing everything in one single location.

Question 3

an interrupt is a signal sent to the processor indicating that immediate attention is required oe **B1**

the processor pauses the current process (after saving its state) to service the interrupt oe **B1**

priority levels ensure more urgent interrupts (e.g. a power failure) are dealt with before less urgent ones (e.g. a printer running out of paper), rather than servicing them purely in the order they arrive oe **B1**

Answer: An interrupt is a signal sent to the processor to request immediate attention, causing it to pause the current process (after saving its state) and run an interrupt service routine. Interrupts are given priority levels so that more urgent interrupts, such as a power failure, are always serviced before less urgent ones, such as a printer running low on paper, regardless of the order in which they occur.

Question 4

recognises that a ratio of 5:1 means compressed size = original size / 5 **M1**

20 / 5 shown as method **M1**

4 MB cao **A1**

Answer: 4 MB

Question 5

(a) Round 1 row correct: 4, 1, 3 (all three values, cao) **B1**

(a) Round 2 row correct: 2, 0, 1 (all three values, cao) **B1**

(a) Round 3 row correct: 0, 0, 0 (all three values, cao) **B1**

(a) Answer: Round 1: 4, 1, 3 Round 2: 2, 0, 1 Round 3: 0, 0, 0

(b) 3 rounds cao **B1**

(b) the loop condition checks whether tasks[0] > 0 OR tasks[1] > 0 OR tasks[2] > 0 oe **B1**

(b) after round 3 all three values are 0, so every part of the OR condition is false, meaning the whole condition is false and the loop stops oe **B1**

(b) Answer: After 3 rounds. The loop condition checks tasks[0] > 0 OR tasks[1] > 0 OR tasks[2] > 0; once all three values reach 0 after round 3, every part of this condition is false, so the whole OR condition is false and the WHILE loop stops.

Question 6

(a) i=1 row correct: -, -, 1 (page fault, all three values cao) **B1**

(a) i=2 row correct: -, 1, 2 (page fault, all three values cao) **B1**

(a) i=3 row correct: 1, 2, 3 (page fault, all three values cao) **B1**

(a) i=4 row correct: 1, 2, 3 (page 1 already in frames, no shift, all three values cao) **B1**

(a) i=5 row correct: 2, 3, 4 (page fault, all three values cao) **B1**

(a) Answer: i=1: -, -, 1 i=2: -, 1, 2 i=3: 1, 2, 3 i=4: 1, 2, 3 i=5: 2, 3, 4 (i=6: 3, 4, 1)

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