



THE UNIVERSITY
OF QUEENSLAND

VENUE:

SEAT NUMBER:

STUDENT NUMBER:

FIRST NAME:

LAST NAME:

(SAMPLE) FINAL EXAMINATION

St Lucia Campus

Second Semester, 2008

COMP3301/COMP7308 - Operating Systems Architecture

PERUSAL TIME 5 mins. During perusal, write on the blank paper provided

WRITING TIME 60 mins

EXAMINER Professor Neil Bergmann

This examination paper has 9 pages (*include title page and attachments*) and printed on Single-Sided

THIS EXAMINATION PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

Exam Type: Closed Book - Specified materials permitted

Permitted Materials: Calculator - Yes - Any type of calculator is permitted
Dictionary - Yes - Any unmarked paper dictionary is permitted
Other – No electronic aids are permitted (e.g. laptops, phone)
One double-sided page of A4 notes (may be printed and/or handwritten) is allowed.

Answer: On examination paper in spaces provided

Number of Questions: 13 Questions in total
Answer all 5 questions in Part A (each question worth 1 mark)
Answer all 5 questions in Part B (each question worth 2 marks)
Answer any 2 out of 3 questions in Part C (each question worth 5 marks)

Weighting/Marks: 25% of total assessment, 25 marks total

Special Instructions: Students must comply with the General Award Rules 1A.7 and 1A.8 which outline the responsibilities of students during an examination.

PART A – Answer all 5 questions in this part

Each Question is worth 1 mark

Answer in the spaces provided

Question A1.

MINIX is a microkernel operating system. What type of kernel structure does Linux use?

A1.

Question A2.

MINIX uses priority-based round-robin scheduling as its standard scheduler. It also moves low-priority processes between queues to avoid what problem?

A2.

Question A3.

One key task of a microkernel such as the MINIX kernel is process scheduling. Name one other key service that the MINIX kernel provides.

A3.

Question A4.

What is the meaning of the acronym **MMU** within a paging memory system?

A4.

Question A5.

One method for managing the list of disks block where a file is stored is a File Allocation Table. What does MINIX use instead of a FAT?

A5.

PART B – Answer all 5 questions in this part

Each Question is worth 2 marks.

Answer in the spaces provided.

Question B6.

Give one advantage and one disadvantage of an operating system where device drivers are in user-space.

B6a. Advantage of user-space device drivers
B6b. Disadvantage of user-space device drivers

Question B7.

List four different types of files in MINIX.

B7a.
B7b.
B7c.
B7d.

Question B8.

Name two scheduling algorithms which might be specifically useful in Real-Time Operating Systems.

B8a.

B8b.

Question B9

In 50 words or less, describe the difference between a process and a thread.

B9.

Question B10

One advantage of segmented virtual memory is that a process can use an address range which is greater than the physical memory present in the computer. In 50 words or less describe another advantage.

B10.

PART C – Answer ANY TWO of the following three questions

Each Question is worth 5 marks.

The best two marks will be used if more than two questions are answered.

Answer in the spaces provided.

You don't need to show working, but working may be used to provide part marks.

Question C11

Five batch jobs A through E arrive at a computer centre at almost the same time in order A (first), B, C, D, E (last). Consider the submission time for each task to be $t=0$. Run times and externally determined priorities are listed in the table below. 1 is the lowest priority, 5 is the highest.

Task	Run-Time	Priority
A	10 minutes	3
B	6 minutes	5 (highest)
C	2 minutes	2
D	4 minutes	1 (Lowest)
E	8 minutes	4

For each of the following scheduling algorithms, determine the turnaround time of each process, and also the mean turnaround time. Ignore process switching overheads.

- (a) Round Robin
- (b) Priority scheduling
- (c) First-come, first-served
- (d) Shortest job first

All jobs are completely CPU Bound. Assume that scheduling algorithm (a) uses pre-emptive scheduling with a time quantum less than a second, so that all jobs get a fair share of the CPU. For algorithms (b) to (d), assume jobs run one at a time until completion.

Question C11 continued on next page

Question C11 (cont)

WORKING

Answers

TASK (Run-time, Priority)	Turnaround Time (Minutes)			
	(a) Round Robin	(b) Priority	(c) FCFS	(d) Shortest Job First
A (10,3)				
B (6,5)				
C (2,2)				
D (4,1)				
E (8,4)				
Mean Turnaround Time				

Question C12

In a system with a segmented virtual address space, each process has its own page table mapping virtual address spaces to physical addresses. Assume addresses are 16 bits, page sizes are 4K, so page table entries are 4 bits (0-15).

Consider the page tables below for each of processes 1,2 and 3. Fill in all the blank spaces in the answer block to describe the mappings between physical and virtual addresses.

	Page Table	Page Table	Page Table	Physical memory
	Process 1	Process 2	Process 3	
F	7	0	A	
E	8	X	F	
D	X	X	X	
C	X	4	X	
B	X	X	X	
A	X	X	X	
9	X	X	X	
8	X	X	X	
7	X	3	X	
6	X	X	X	
5	X	X	X	
4	X	X	X	
3	X	X	C	
2	X	X	D	
1	9	1	E	
0	6	2	B	

ANSWERS – Complete all 12 blank entries in table below:

Process Number	Virtual Address	Physical Address
1	1ABC	
2	1ABC	
3	1ABC	
1	EA12	
2	EA12	
3	EA12	
		0012
		AFCD
		5234

Question C13

Write short explanations (less than 50 words each) of what each of the following sections of a MINIX filesystem layout contains.

C13 (i) Boot block
C13 (ii) Superblock
C13 (iii) I-nodes bit map
C13 (iv) Zone bit-map
C13 (v) I-nodes
C13 (vi) Data

Page Left Blank for Working, or for any corrected answers from earlier.

END OF PAPER