



INSTITUTE OF TECHNOLOGY TRALEE

AUTUMN EXAMINATIONS AY 2012-2013

Operating Systems

COMP61008

CRN: 43835

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Duration: 2 Hours

Instructions to candidates: Answer any THREE questions. All questions carry equal marks (33 marks).

Question 1. Process Management

Note: assume here that there is a single CPU.

(a) Three processes, A and B and C are in memory. Process A is in memory locations 5000 to 5500. Process B is in memory locations 6000 to 6450. Process C is in memory locations 7000 to 12000.

The Operating System dispatcher/scheduler is located at memory address 100 and it contains 8 instructions.

(i) Draw a diagram to illustrate the contents of memory. **(4 marks)**

Processes are queued in the order A, B, C. Round-robin scheduling is used and the time quantum is 10 instruction cycles. Process A requests an I/O action, for which it must wait, after 15 instructions are executed.

(ii) Show a trace of this system for 70 instruction cycles. **(12 marks)**

The following are the first few lines:

Instruction Cycle Number	Instruction address
1	5000
2	5001
...	...
10	5009

(b) The 3 states of a process are running, blocked and ready.

(i) Describe each of these states. **(6 marks)**

(ii) From the process trace for (a)(ii) above, state where process A is in each of these states. **(6 marks)**

(c) Explain what is meant by a context switch? Give one example of where a context switch occurs in the process trace you wrote for (a)(ii) above. **(5 marks)**

Question 2. Scheduling

(a) The simplest scheduling algorithm is FCFS (First-Come, First-Served). Describe this algorithm. **(2 marks)**

(b) Shortest –Job-First (SJF) scheduling is another algorithm used. Two schemes can be used for this algorithm:

- nonpreemptive
- preemptive – also called Shortest-Remaining-Time-First (SRTF)

Describe the difference between these two schemes. **(6 marks)**

(c)

The following table shows the arrival and burst times of 4 processes:

Process	Arrival Time	Burst Time
P1	0	7
P2	1	5
P3	3	2
P4	6	4

Draw Gantt charts for each of the following scheduling algorithms

- FCFS
- Nonpreemptive SJF (Shortest-Job-First)
- Preemptive SJF (also called Shortest-Remaining-Time-First (SRTF))

For each algorithm give the waiting time and turnaround time of each process. Also, give the average waiting time for each algorithm. Which algorithm gives the best result for average waiting time? **(25 marks)**

Question 3. Memory Management

(a) Contiguous Allocation is one method that can be used to allocate memory. It can use one of three algorithms:

- First-fit allocation
- Best-fit allocation
- Worst-fit allocation

(i) Briefly describe any two of these algorithms. **(4 marks)**

(ii) Assume memory has the following holes (free blocks) in order:
10K, 40K, 10K, 30K, 10K, 20K

For the two algorithms you chose in (i) above, show how they would place processes of 10K, 25K, 20K (in that order)? **(8 marks)**

(b) Paging is another method that can be used to allocate memory.

(i) Describe how paging differs from Contiguous Allocation and describe how it allocates memory.

In your answer, include an explanation of the following terms:

frame, page, page table, free-frame list. **(13 marks)**

(ii) Assume the free-frame list is 16, 15, 19, 9, 20, 13, 25.

A new process has 5 pages.

What are the contents of the free-frame list after memory has been allocated to this process? Give a diagram to show where in memory the new process is located. Also give the contents of the page table for the new process. **(8 marks)**

Question 4. Linux

(a) The following Linux commands are issued in the order specified. Describe the effect of each command. Assume that you are in your home directory initially and that testfile does not exist.

- (i) touch testfile
- (ii) mkdir mydocuments
- (iii) mv testfile mydocuments
- (iv) cd mydocuments
- (v) ls
- (vi) cat testfile
- (vii) rm testfile
- (viii) cd ..
- (ix) man pwd
- (x) pwd
- (xi) startx

(16 marks)

(b) The following is one of the lines of output from the `ls -l` command:

```
-rwxr-xr-x  1  t00012345  students 4096 Jun 27 15:30  datafile
```

- (i) How do you know that datafile is a file and not a directory? **(2 marks)**
- (ii) Who owns this file? **(1 mark)**
- (iii) Who is the group owner of this file? **(1 mark)**
- (iv) What do the date and time, on this line of output, indicate? **(1 mark)**
- (v) Explain the meaning of `rwxr-xr-x` in this output. **(6 marks)**

Assume the following command is given:

```
chmod g+w datafile
```

- (vi) What changes does this command make to the permissions on test? **(3 marks)**
- (vii) What changes does it make to the output from the `ls-l` command? **(3 marks)**