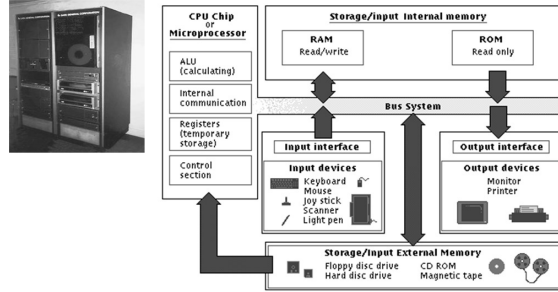


# COMP25111

## Operating Systems

### Lectures 13:

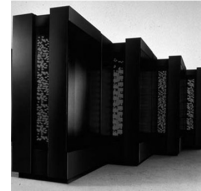
### Virtual Memory (3)



© Copyright Richard Neville 2007

Dr Richard Neville  
[r.neville@manchester.ac.uk](mailto:r.neville@manchester.ac.uk)

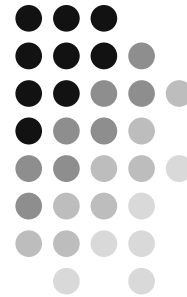
Room: G12 Kilburn Building, Bottom floor



Week

8

NOTE: The up-to-date version of this lecture is kept on the associated web site -- available [on-line] @ Blackboard select: COMP15111 Introduction to Computer Systems [www.manchester.ac.uk/portal](http://www.manchester.ac.uk/portal)



1

## Students Copy

Short Exam Questions

Q1

- Question  
 State the **three issues** Segmented Virtual Memory support with respect to the computer system as a whole.  
 ANSWER(S):  
 1) Operating system;  
 2) System software; and  
 3) Programmers in managing processes in a multitasking operating system.

© Copyright Richard Neville 2007

- NOTE: In the exam approximately 2 question are taken from the topics (and program examples) covered in each lecture.

2



# Getting ready for next week

## Do next week's Q3's NOW

© Copyright Richard Neville 2007

- Once you have re-read the lecture notes; and listened to the audio recording [while stepping through the PPT] of the lecture again:
- Please have a think about next week's Q3's
  - on the next page
- If you try to answer the Q3's now you will be in a much better position to recall the information.
- Once you have done this, transfer your answers to next weeks "Student [OWN answers] version" at the start of next weeks lecture.
  - YES this implies bringing the last weeks lecture notes to the next lecture ...

3



© Copyright Richard Neville 2007

1. Question  
State the **three issues** Segmented Virtual Memory support with respect to the computer system as a whole.  
ANSWER(S):  
a) Operating system;  
b) System software; and  
c) Programmers in managing processes in a multitasking operating system.
2. Question  
Give two reasons why 'segments' support the management of the execution of multiple processes in an operating system :  
ANSWER(S):  
a) ensure that processes do not interfere with one another;  
b) ensure that operating system has control of the computer and will prevent programs written by users taking over the computer.
3. Question  
Give the names of the two fields the segment address is split into.  
ANSWER(S):  
• The segment address is divided into two fields:  
1) Segment Number; &  
2) Offset.



# Questions

## Introduction to Questions:

The set of questions are based on lecture 13.

Answer Sheet will be given later in year and will contain the answers to these questions.

© Copyright Richard Neville 2007

- Remember to find detailed and comprehensive answer you should [also] reference associated text books in the library.
- A reasonable starting place for associated book titles are:
  - 1) This units 'module guide'; given to you in RN's first lecture – or on the web [Blackboard];
  - 2) Those books mentioned in 'Background Reading;'
  - 3) Those books [and web resources] mentioned in Learning Resources.

5



# Questions

## 1. Question:

- Draw up a table that lists:
  - 1) [Page] Replacement policy name; &
  - 2) Brief description of how the policy works.

© Copyright Richard Neville 2007

6

**1. Answer:**

Policy name	Description of how the policy works
First in First Out (FIFO)	“Based on the theory that the best page to remove is the one that has been in memory the longest. <sup>1</sup> ”
Least Recently Used (LRU)	“Policy chooses the pages least recently accessed [referenced] to be swapped out. <sup>1</sup> ”
Not Recently Used (NRU)	“Replace the page which is <i>not used recently</i> . <sup>2</sup> ”

© Copyright Richard Neville 2007

Footnote 1: Reference - [Understanding operating systems - Google Books Result](#) by Ida M. Flynn, Ann McIver McHoes - 1997 - Computers - 438 pages, available from Google books [on-line] @ [http://books.google.co.uk/books?id=QRoOAAAAQAAJ&pg=PA55&lpg=PA55&dq=Page+replacement+Policy+used+by+First+in+First+Out+\(FIFO\)&source=bl&ots=pke1VWtQ1D&sig=0fSQXdJD2bY3KAn4a98GI0rHw&hl=en&ei=CHVoSrDvK5KsJAfWgvCiCw&sa=X&oi=book\\_result&ct=result&resnum=1](http://books.google.co.uk/books?id=QRoOAAAAQAAJ&pg=PA55&lpg=PA55&dq=Page+replacement+Policy+used+by+First+in+First+Out+(FIFO)&source=bl&ots=pke1VWtQ1D&sig=0fSQXdJD2bY3KAn4a98GI0rHw&hl=en&ei=CHVoSrDvK5KsJAfWgvCiCw&sa=X&oi=book_result&ct=result&resnum=1)

Footnote 2: Reference - [Chapter 3.3 : OS Policies for Virtual Memory](#); available from Google books [on-line] @ [www.ceng.metu.edu.tr/~genc/334/Ch\\_33\\_OSVir.ppt](http://www.ceng.metu.edu.tr/~genc/334/Ch_33_OSVir.ppt)

**2. Question**

**State three reasons why it is necessary for processes to share memory.**

© Copyright Richard Neville 2007



## 2. Answer

- In some cases it is necessary for processes to share memory:
  - 1) Shared user code;
  - 2) Shared data space (e.g. Unix pipes); or
  - 3) Shared Library Code (dll's).



## 3. Question

In the context of permission information:  
like read (R), write (W), & execute (X).

What can the RWX permission  
information control access to; with  
respect to security and protection?

### 3. Answer

- **Permission information: like R, W, & X. can be used to control access, for example:**
  - 1) Code can be marked 'read only';
  - 2) Page tables can be marked 'read only'; or
  - 3) Data can be 'read/write' but not 'execute'.

### 4. Question

On a paged machine with 3 pages frames available for it, a particular process makes accesses to the following pages in the order given:

0, 7, 3, 1, 2, 3, 1, 7, 3

Show the contents of the 3 page frames and the cumulative total number of page faults after each memory access assuming that an LRU page replacement algorithm is in use and that the page frames are initially empty.

The type of diagram you should draw up is depicted in figure below:

Access:	0	7	3	1	2	3	1	7	3		
Most recent:	X	X	X	X	X	X	X	X	X	)	Contents of
Second most :	X	X	X	X	X	X	X	X	X	)	page frames
Third most:	X	X	X	X	X	X	X	X	X	)	in memory
Total PFs:	X	X	X	X	X	X	X	X	X		

Typical diagram showing 3 page frames and the cumulative total number of page faults.

**4. Answer**

For 0, 7, 3, 1, 2, 3, 1, 7, 3:

Access:	0	7	3	1	2	3	1	7	3		
Most recent:	0	7	3	1	2	3	1	7	3	)	Contents of
Second most :	-	0	7	3	1	2	3	1	7	)	page frames
Third most:	-	-	0	7	3	1	2	3	1	)	in memory
Total PFs:	1	2	3	4	5	5	5	6	6		

**Revision Exercises**

- Scan read Lecture 13's Questions.
  - Answer Lecture 13's Questions
    - Particularly those questions you had difficulties with when you first tried them.