FIT2100 Tutorial #7
Virtual Memory
Week 11 Semester 2 2019

October 9, 2019

Revision Status:

`$Id: FIT2100-Tutorial-06.tex, Version 2.0 2018/10/02 13:45 Jojo $`

`Updated Oct 2019 by Daniel Kos`

Acknowledgement

The majority of the content presented in this tutorial was adapted by Dr Jojo Wong from: William Stallings (2017). *Operating Systems: Internals and Design Principles*, Pearson.

Contents

1 Background

This tutorial provides students with the opportunity to explore further on the various concepts of memory as discussed in the lectures.

You should complete the suggested reading in Section 2 before attending the tutorial. You should also prepare the solutions for the two sets of practice tasks given in Section 3 and Section ?? respectively.

2 Pre-tutorial Reading

You should complete the following two sets of reading:

- Lecture Notes: Week 10
- Stallings' textbook (5th–9th Edition): Chapters 7, 8.

3 Memory Management

3.1 Review Questions

Question 1

What is the difference between *internal* and *external* fragementation?

Question 2

What is the difference between a *page* and a *frame*?

Question 3

What is the difference between a *page* and a *segment*?

Question 4

How does the use of *virtual memory* with paging improve system utilisation?

3.2 Problem-Solving Tasks

3.2.1 Task 1

Given free partitions in memory of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the **first-fit**, **best-fit**, and **worst-fit** algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of the memory? (Note: For the worst-fit algorithm, a process is allocated with the largest free block of memory.)

3.2.2 Task 2

A page replacement algorithm should minimise the number of *page faults*. Some common page replacement algorithms are: **FIFO**, **LRU**, and **Optimal** algorithms. How many page faults occur for each algorithm for the following sequence of page references with four page frames (assuming all four page frames are initially free)?

1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 2

3.2.3 Task 3

Consider a simple segmentation system that has the following segment table:

Segment #	**Starting Address**	**Length (bytes)**
0	660	248
1	1752	422
2	222	198
3	996	604

For each of the following logical addresses (segment number, offset), determine the physical adddress or indicate if a segment fault occurs:

(a) 0, 198

(b) 1, 515

(c) 3, 445