

Arab Academy for Science, Technology, and Maritime Transport  
College of Engineering and Technology  
CC418 - Operating Systems  
Lecturer: Dr. Ayman Adel Abdel-Hamid  
TA: Eng. Shereen Oraby  
Term: Spring 2012

### Section Assignment #1

Date Assigned: Week of Sunday, Feb. 26<sup>th</sup> (Week 2)  
Date Due: Week of Sunday, March 4<sup>th</sup> (Week 3). Late assignments will not be accepted.  
Submissions should be typed. Be sure to write your name, registration number, assignment number, and lecturer and TA name in the header.

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The following problems are taken from Chapter 1 of "Operating Systems: Internals and Design Principles" by William Stallings (7<sup>th</sup> Edition).

1.10) Consider the following code:

```
for (i _ 0; i _ 20; i++)  
    for (j _ 0; j _ 10; j++)  
        a[i] _ a[i] * j
```

- a. Give one example of the spatial locality in the code.
- b. Give one example of the temporal locality in the code.

1.12) Consider a memory system with the following parameters:

$T_c$  \_ 100 ns  $C_c$  \_ 0.01 cents/bit  
 $T_m$  \_ 1,200 ns  $C_m$  \_ 0.001 cents/bit

- a. What is the cost of 1 MByte of main memory?
- b. What is the cost of 1 MByte of main memory using cache memory technology?
- c. If the effective access time is 10% greater than the cache access time, what is the hit ratio  $H$ ?

1.13) A computer has a cache, main memory, and a disk used for virtual memory. If a referenced word is in the cache, 20 ns are required to access it. If it is in main memory but not in the cache, 60 ns are needed to load it into the cache (this includes the time to originally check the cache), and then the reference is started again. If the word is not in main memory, 12 ms are required to fetch

the word from disk, followed by 60 ns to copy it to the cache, and then the reference is started again. The cache hit ratio is 0.9 and the main-memory hit ratio is 0.6. What is the average time in ns required to access a referenced word on this system?