

**COMP 3000 OPERATING SYSTEMS
WINTER 2013
MIDTERM - ANSWERS**

QUESTION 1

$$\begin{aligned} \text{Average access time} &= 0.90 \times 1 \text{ nsec (word is in level one cache)} \\ &+ 0.10[\\ &\quad 0.85 \times 2 \text{ nsec (word is in level two cache)} \\ &\quad + 0.15(0.80 \times 10 \text{ nsec (word is in RAM, but not in cache)} \\ &\quad + 0.20 \times 10,000,000 \text{ nsec) }] \text{ (word in on disk only)} \\ &= 30 \text{ usec} \end{aligned}$$

QUESTION 2

During a system call, the TRAP instruction transfers the control of the CPU from the process (the caller) to the kernel of the operating system (the callee).

QUESTION 3

Undefined(parent is shell)-->1 (1st child)-->2 (2nd child)-->3 (3rd child)

QUESTION 4

Let p be the fraction of time a process is waiting for I/O. With n processes in memory, the CPU utilization is $1 - p^n$. In this problem, p is 80% and n is four. $1 - p^n = 1 - 0.8^4 = 59\%$.

QUESTION 5

```
while (TRUE) {
// wait_for_work
// get exclusive access to variables
pthread_mutex_lock(&the_mutex);
while (empty(queue)) pthread_cond_wait(&condc, &the_mutex);
request=dequeue(queue);
available--;
// release access to variables
pthread_mutex_unlock(&the_mutex);

// process the request
look_for_page_in_cache(&request, &page);
if (page_not_in_cache(&page))
read_page_from_disk(&request, &page);
return_page(&page);

// return to wait state
// get exclusive access to variables
pthread_mutex_lock(&the_mutex);
available++;
pthread_cond_signal(&condp);
// release access to variables
pthread_mutex_unlock(&the_mutex);
}
```