Exam #1

CSE 3320.002

Spring 2017

Name: _____

UTA ID:_____

"I certify that the following work is my work alone and I will follow the highest standards of integrity and uphold the spirit of the Honor Code"

Signature:_____

Directions: This is a closed book, closed notes exam. You may use a hand written 3x5 note card with notes. Please answer the questions briefly. Complete sentences are not necessary. Write your answers legibly. Unreadable answers will be counted wrong. There is a powers of 2 table on the last page.

1. [6pts] What are the two main functions of an operating system?

2. [6 pts] What data structure is used by the OS to handle interrupts? How does it work?

3. [6 pts] Modern operating systems decouple a process address space from the machine's physical memory. List two advantages

4. [5 pts] For the following code, what will be printed? For return values from fork use any integer that makes sense from a system standpoint:

```
#include <stdlib.h>
#include <unistd.h>
#include <stdio.h>
#include <sys/wait.h>

int main ()
{
  int status;
  int child_pid = fork();
  if( child_pid == 0 )
  {
    wait(&status);
    printf("Les Miserables\n");
  }
  else
  {
    wait(&status);
    printf("Hamilton\n");
  }

  int pid = fork();
  if( pid != 0 )
  {
    wait( &status );
    printf("Rent\n");
    return 0;
  }
  else
  {
    wait( &status );
    printf("Wicked\n");
    return 0;
  }
  return 0;
}
```

5. [6 pts] You are given a choice of two TLB. Type A executes lookups parallel and has a memory access time of 170ns and a TLB lookup time of 30ns with a 75% hit rate. Type B executes lookups in serially and has a memory access time of 170ns and a TLB lookup time of 20ns and a 75% hit rate. From a purely performance perspective, which TLB should you choose? Quantify why.

6. [5 pts] What is a context switch? When is it used in an OS?

7. [6 pts] What is external fragmentation?

8. [6 pts] What are the differences between a microkernel and a monolithic kernel? Give two advantages of each.

9. [8pts] A computer has 4GB of RAM of which the operating system occupies 512 MB. The processes are all 256 MB and have the same characteristics. If the goal is 99% CPU utilization, what is the maximum I/O wait time that can be tolerated.

10. [6pts] What is the biggest advantage of implementing threads in user space? What is the biggest disadvantage?

Process ID	Arrival Time	Runtime (seconds)	Priority
1	0	2	4
2	0	4	2
3	3	4	1
4	5	3	3
5	8	3	1
6	12	10	4
7	15	5	2

11. [6 pts] Given the table above, show the GANTT chart for a Priority with Preemption scheduler. Lowest priority value is the highest priority.

12. [6pts] For problem 11, give the average response time, average wait time and average turnaround time

13. [6pts] Given a page request reference string of D A B C F E A F B A C H C A D B and a page table size of four, calculate how many page faults will occur with the optimal page replacement algorithm. If all pages are equally replaceable pick the first available. Show your work.

14. [8pts] Given a swapping system in which memory consists of the following hole sizes in memory order: 10 MB, 4 MB, 20 MB, 18 MB, 7 MB, 9MB, 12 MB, and 15MB. Which hole is taken for successive requests of: 12 MB, 10 MB, 9MB. Give your answer for first fit, best fit, worst fit, and next fit.

15. [8pts] Given a 32 bit processor, with 2 MB of physical RAM split into 512 frames. What is the size of the single level page table, in entries, if the maximum addressable virtual memory space is 16MB

16. [5pts] Briefly explain priority inversion.

A

n	2^n	n	2^n	n	2^n
0	1	11	2,048	22	4,194,304
1	2	12	4,096	23	8,388,608
2	4	13	8,192	24	16,777,216
3	8	14	16,384	25	33,554,432
4	16	15	32,768	26	67,108,864
5	32	16	65,536	27	134,217,728
6	64	17	131,072	28	268,435,456
7	128	18	262,144	29	536,870,912
8	256	19	524,288	30	1,073,741,824
9	512	20	1,048,576	31	2,147,483,648
10	1,024	21	2,097,152	32	4,254,967,296