CS 4760	**Operating Systems**	Test 1
Name:	Fall 2021	Max Pts: 56

Important: This is an open book test; you can use any books, notes, or paper. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem.

1. [6 pt] What is the distinction between spatial locality and temporal locality?

2. [6 pt] What is the role of `ioctl` in the OS kernel?

3. [10 pt] A computer has cache, main memory, and a disk used for virtual memory. If a referenced word is in the cache, 15ns are required to access it. If it is in main memory but not in the cache, 50ns are required 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, 11ms are required to fetch the word from disk, followed by 50ns to copy it to the cache, and then, the reference is started again. The cache hit ratio is 0.8 and the main memory hit ratio is 0.9. What is the average time in ns required to access a referenced word on this system?

4. [10 pt] List and briefly explain five storage management responsibilities of a typical OS.

5. [6 pt] What is an instruction trace? What is the difference between the instruction trace for a single process and multiple processes executing on a uniprocessor?

6. [12 pt] The following state transition table is a simplified model of process management, with the labels representing transitions between states of `READY`, `RUN`, `BLOCKED`, and `NONRESIDENT`.

	READY	RUN	BLOCKED	NONRESIDENT
READY	-	1	-	5
RUN	2	-	3	-
BLOCKED	4	-	-	6

   Interpret transition 2 as the fact that the process can change from `RUN` to `READY`. Give an example of an event that can cause each of the above transitions. Draw a diagram if that helps.

7. [6 pt] I wrote the following code to create a child to do something and return. The return value is to be caught by the parent. Can you see any problem with the code that I wrote? How will you fix it?

```
int status;
pid_t pid = fork();
if ( pid < 0 )
    exit ( 1 );
if ( pid == 0 )
    wait(&status);
exit ( 0 );
```

8. [8 pt] What is the difference between the semantics of wait/signal operations in case of semaphores and condition variables?