

Full Name: \_\_\_\_\_

AID: \_\_\_\_\_

## CS 351 Midterm Exam Worksheet

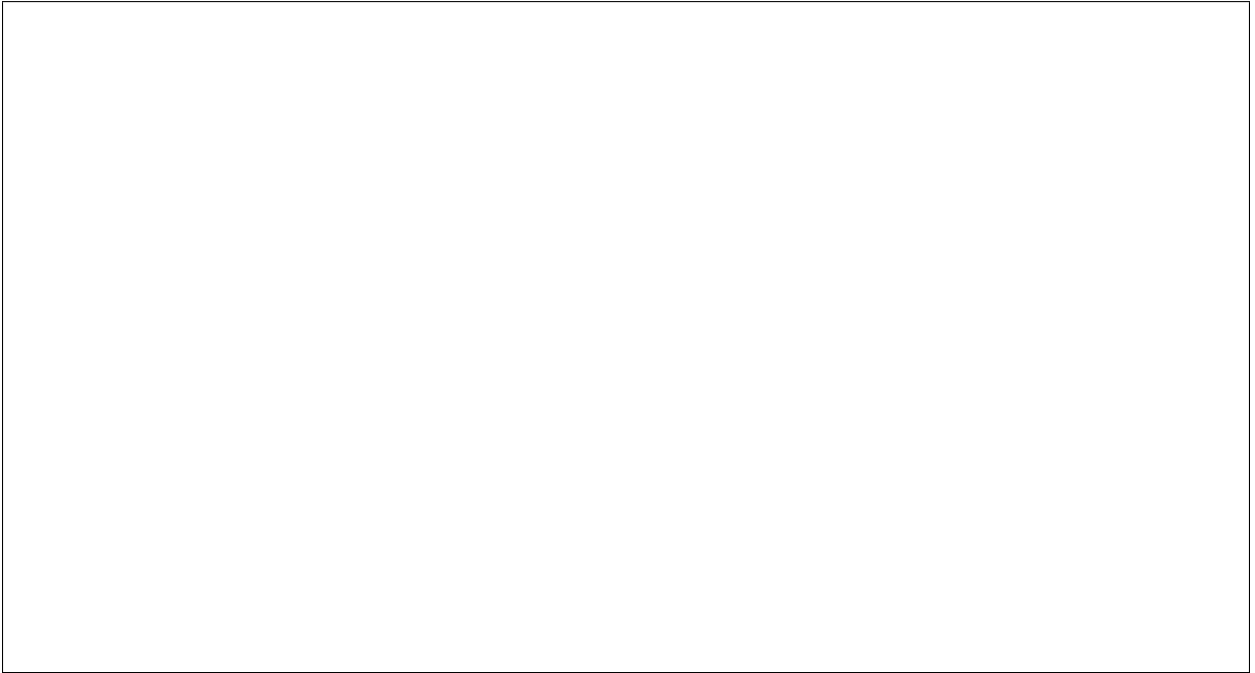
|               |
|---------------|
| WP1 (/8) :    |
| WP2 (/8) :    |
| WP3 (/8) :    |
| WP4 (/8) :    |
| TOTAL (/32) : |

## WP1.

```
void free_pyr(pyr_t *p) {
    for (int i=0; i<p->n; i++) {
        free(p->levels[i]);
    }
    free(p->levels);
    free(p);
    return ;
}
```

**WP2.**

A)



B)



**WP3.**

A)

1 or 2. 1 may be output if the second signal arrives before the first one is delivered. [Student may also just point out that signals aren't queued. Note that "0" is also acceptable as an additional answer to any part of this problem, for the reason that the parent may reap the child and terminate before any of the signals are delivered.]

B)

1, 2, or 3. 1 or 2 may be output if later signals arrive before the earlier ones are delivered. [Same explanation as above.]

C)

1 or 2. The second signal may preempt the first handler, resulting in a race condition that causes the increment operation to be interrupted. [The student doesn't need to use these exact words, just describe the essential idea.]

D)

1, 2, 3, or 4. The first signal handler can be preempted, resulting in a race condition that causes the increment to be interrupted. Subsequent signals may not be queued. [The student doesn't need to use these exact words, just describe the essential idea.]

#### WP4.

1. May just want to duplicate a process that is running the same program (i.e., fork without exec). E.g., maybe in creating a new browser tab.
2. May just want to run a new program within the current process without creating a new process (i.e., exec without fork). E.g., during the Unix startup process, after logging in, replace the login program with the shell program in the same process.
3. Allow the parent's program to manipulate the process after forking and before exec-ing, so that the environment for the new program is configured correctly. E.g., the shell can change the group ID of the child process after forking and before exec-ing the new program in it.

Note: student examples do not need to be as detailed, so long as the gist is there.