

CS 377 – Operating Systems  
Discussion Session 3 Questions

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

Write your answers individually without consulting your notes, the textbook, or the internet. Be succinct (complete sentences not necessary). **Remember to turn your paper over.**

1. **Process Lifecycle.** The lifecycle of a process consists of five execution states, which are (in no particular order): running, terminated, new, ready, and waiting. Say what each of these states means in a few words and fill in the state labels in the sequence graph shown below.

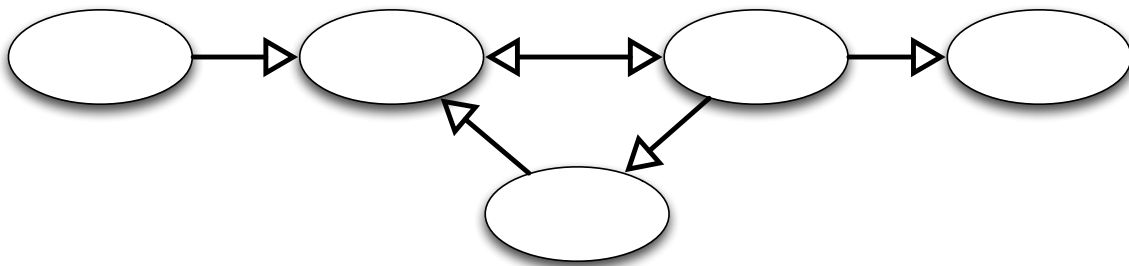


Figure 1: A state sequence graph depicting the lifecycle of a process.

2. **Process Communication.** Two models of process communication are message passing and shared memory. Which model would you use for describing the scenario of (a) having a face-to-face conversation, and (b) communicating by letters? Briefly justify.

3. **Process Creation and fork.** Consider the following C program:

```
1  #include <stdio.h>
2
3  int main() {
4      printf("1");
5      int pid = fork();
6      if (pid > 0) {
7          waitpid(pid, 0, 0); // wait until process ID pid has terminated
8          printf("2");
9      }
10     pid = fork();
11     if (pid > 0) {
12         waitpid(pid, 0, 0);
13         printf("3");
14     } else {
15         printf("4");
16         return 0;
17     }
18     printf("5");
19     return 0;
20 }
```

- (a) Including the initial process launched when the program is started, how many processes are created from running the above program?
- (b) Assuming no output buffering (that is, output from each `printf` is written to the screen immediately), what is the output from running the above program?
- (c) Suppose we delete the call to `waitpid()` at line 12. Would this change your answer to part (b)? Why or why not?