p2q1c

SMH

Tripos 1999/2000: Short Question for Operating Systems (1A)

Question 1 (4 Marks)

Describe the operation of the Unix shell with reference to the process management system calls it makes use of. You might like to use pseudo-code or a diagram to aid with your description. [4 marks]

Extended Answer to Question 1

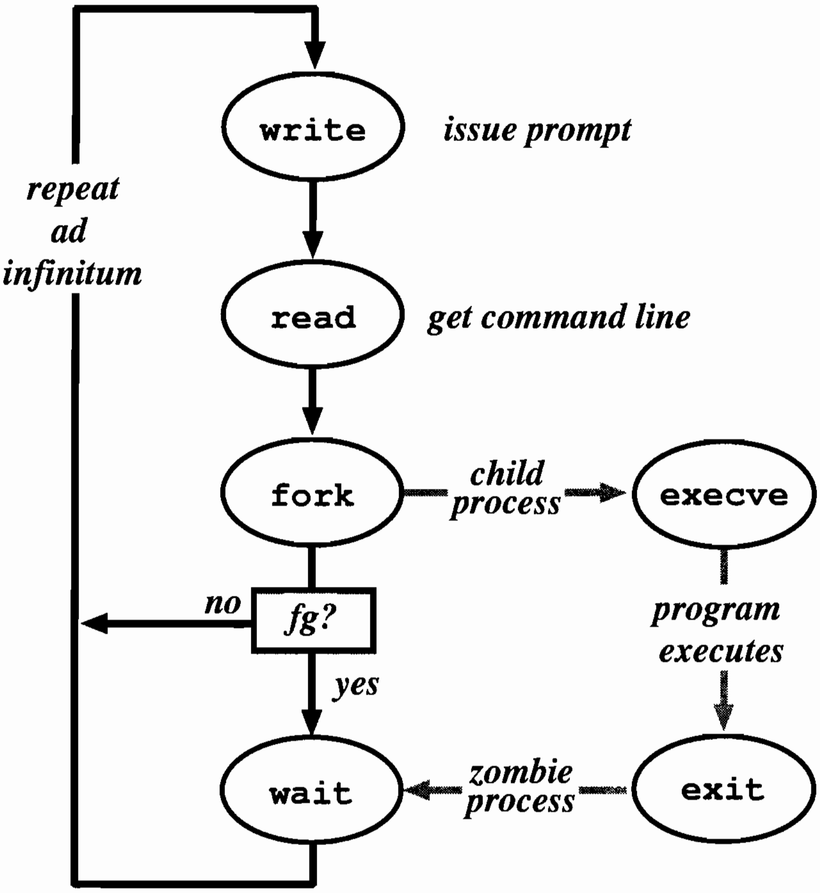
The main process management system calls used by a shell are `fork()`, `exec()`, `wait()` and `exit()`. The key thing here is to get the ordering / interaction of these correct. Don't require info about backgrounding, job control, process groups, etc.

In its steady state, the shell (parent) repeatedly executes the following steps: read command line, parse command line, locate executable, invoke `fork()`, invoke `wait()`, repeat. The *child* process comes into being after the invocation of `fork()` and will then invoke `exec()` to replace its image with that of the executable, run for a while and eventually invoke `exit()`. This will unblock the parent and allow it to read in a new command line. Note: since the above `exit()` system call is not actually present in the text of the parent it is reasonable for the answer to omit this providing understanding is shown.

Or, in pseduo-code, something like the below:

```
while(!done) {
   line    = read_command_line());
   command = parse(line, /* out /* &args);
   procid  = fork();
   switch(procid) {
      case -1: /* error return */
         printf("fork() failed, error %d\n", errno);
         break;
      case 0:  /* child process */
         execve(command, args);
         break;
      default: /* parent process */
         wait(&status);
         break;
   }
}
```

Or, using a diagram, something like the below:



Note: the above diagram is from the course notes, so you might expect to see several answers containing substantially similar ones.