These questions are provided to you to help you study material covered in CS 241 that may appear on the final exam. These exact questions may or may not appear on the final exam, but the topics they cover will almost certainly be on the final exam.

1. Consider the code below:

```
int main() {
  int *ptr = mmap(NULL,
                  sizeof(int),
                  PROT_READ | PROT_WRITE,
                  MAP_SHARED | MAP_ANONYMOUS,
                  -1,
                  0);

  *ptr = 0;
  fork();
  (*ptr)++;

  printf("The value is: %d\n", *ptr);
}
```

   What all is printed out after the program is executed?

2. The `pipe()` system call takes in an array of two integers, returning two file descriptors. How do the two returned file descriptors differ? How should they be used?

3. Synchronization (such as mutexes, semaphores, or conditional variables) are often not used with pipes. Why?

4. When is synchronization required when using a mmap?

5. Explain why a pipe cannot be used in all instances. Give an example when a different form of stream-based IPC must be used because a pipe cannot be used.