A Dialogue on the Book

Abstraction Layers

What is an Operating System?

1. Main purpose:

2. What is virtualization?

3. How do users interact with the OS?
Operating Systems Design Goals

1. Use abstractions to make the system convenient and easy to use.
2. Provide high performance (minimize overheads)
3. Provide protection between applications, and between the OS and (malicious) applications
4. Provide a high degree of OS reliability
5. Be energy efficient
6. Have mobility to work on smaller devices

A Brief History of OS – check out the Myth of Multi-Tasking: https://www.youtube.com/watch?v=xO_oEGHWSMU

Three easy pieces: Virtualization, Concurrency, and Persistence

Virtualizing the CPU: How do we run, for instance, 4 programs on one CPU?

```c
int main(int argc, char *argv[])
{
    char *str = argv[1];
    while (1)
    {
        printf("%s\n", str);
        Spin(1); // wait one second
    }
}
```
Virtualizing Memory: Can different programs access each other’s memory?

```c
int main(int argc, char *argv[])
{
    int *p;            // memory for pointer is on "stack"
    p = malloc(sizeof(int)); // malloc'd memory is on "heap"
    assert(p != NULL);

    int myid = (int) getpid();
    printf("(pid:%d) addr of p:    %p\n", myid, &p);
    printf("(pid:%d) addr stored in p: %p\n", myid, p);
}
```

Concurrency:

```c
volatile int counter = 0;
int loops;

void *worker(void *arg)   // each thread runs this function
{
    int i;
    for (i=0; i<loops; i++)
        counter++;
    pthread_exit(NULL);
}

int main(int argc, char *argv[])
{
    loops = atoi(argv[1]);
    pthread_t p1, p2;
    printf("Initial value : %d\n", counter);
    pthread_create(&p1, NULL, worker, NULL);
    pthread_create(&p2, NULL, worker, NULL);
    pthread_join(p1, NULL);
    pthread_join(p2, NULL);
    printf("Final value   : %d\n", counter);
}
```

What does the above code output if we run it as “./thread 20”?

What about with “./thread 1000000”?

Why?
Persistence

Finally, from your predecessors

1) I learned about the powers of procrastination.

2) I think my classmates and I are struggling with the length of these assignments because it's relatively new to us. In every other project throughout the curriculum, it's been easy to imagine the first step and get a sense of the overall process. (In part, this is because, in other classes, the class IS the project--when you sit down in CS302, you learn about the structure of a binary tree. I feel like the lecture portions and assignments are more disjointed than that in OS.) I think it's necessary to go beyond that and attempt what the OS course has--that is to say, it's necessary to push students to design structures that, initially, they don't understand at all.