CS241 - Intro to Threads

Today we are going to be going over threads and their usefulness along with their applications.

Terminal Trick of the Day!

Tab complete: If you’re typing the name of a command or file in your shell, press tab to automatically complete as much of its name as possible. If multiple files share a prefix, press tab twice to show a list of matches. For example, if you wanted to find your Extreme Edge Cases lab in your SVN, and had typed cd ~/.cs241/e, pressing tab would complete it to cd ~/.cs241/extreme_edge_cases/, and pressing tab again would show files in that directory.

Fixing Non-Reentrant Code

Change this code so that it is thread-safe.

```c
char* perror_r(char *what) {
    static char buffer[4096], errname[100];
    int written = snprintf(buffer, 4096, "%s:%s", what, errname);
    write(2, buffer, written);
}
```

In multithreaded code, there is a strong notion of ownership when it comes to memory and memory errors. Many of the functions and data structures you will be writing will return a pointer and remove the data from the data structure entirely. If we didn’t have this sense of “a thread owns this piece of memory”, what would happen? (Hint: think of the example that we just did.)

Splitting Work Up

If you look at today’s lab, it involves an highly parallel problem. What does that mean?

Let’s say that we have an array that we want to split up between threads. Each thread will compute this loop.

```c
for (int j = left_boundary; j < right_boundary; ++j) {
    do_someting_with_element(A[j]);
}
```

Complete this function that will divide the work up so that all of the array elements are split as equally as possible and so that none of the elements overlap and all elements get covered. (Hint: why may one be different?)

```c
worklist_t *split_work(int thread_num, int num_threads, int array_len) {
    worklist_t work = malloc(sizeof(worklist_t))
    if (thread_num == 0) {
        work->left_boundary =
        work->right_boundary =
    } else {
        work->left_boundary =
        work->right_boundary =
    }
    return work;
}
```
Trace the Threads

Draw out the thread-join diagram for the following code (just like the process diagram)

```c
void* work(void *data){
    sleep(1);
    if(data)
        pthread_join((pthread_t)data, NULL);
    return NULL;
}

int main(){
    pthread_t thread = (pthread_t)NULL;
    for(int i = 0; i < 5; ++i){
        pthread_create(&thread, NULL, work,
                        (void*)thread);
    }
    pthread_join(thread, NULL);
}
```