CPSC 410

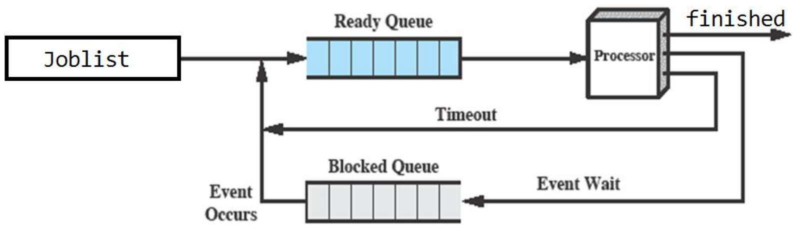
Project 2

Motivation: Topics covered by this project;

- Queuing and the processor
- Chapter 3 in Stallings

Overview

You are to simulate the process queuing model shown from figure 3.8 in your text. Please read the course text and thoroughly understand how this model works before starting this project.



I have provided much of the infrastructure, you fill in the rest. This project builds off of project 1. Note that it runs in a single thread, so you don't have to worry about the complexity associated with multiple threads.

Teams

Please work 2 to a team. Please include a description of what each team member did as part of your submission. Percentage responsibility for the final product is fine.

Overview

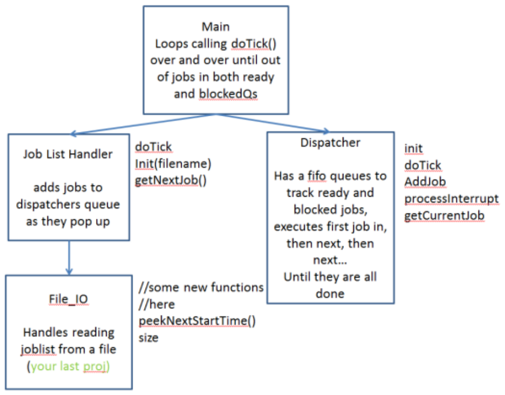

Main
Loops calling doTick() over and over until out of jobs in both ready and blockedQs
Job List Handler
adds jobs to dispatchers queue as they pop up
doTick
Init(filename)
getNextJob()
Dispatcher
Has a fifo queues to track ready and blocked jobs, executes first job in, then next, then next…
Until they are all done
init
doTick
AddJob
processInterrupt
getCurrentJob
File_IO
Handles reading joblist from a file
(your last proj)
//some new functions
//here
peekNextStartTime()
size

Figure 1 Module interaction

File_io (given to you)

This set of functions duplicates what you did in project 1. I changed the name of the structure from process_stats to PCB to conform to the notion of a process control block. Note the 2 extra functions;

```
//returns when the next job starts without altering the container
int peekNextStartTime();

//return the number of elements
//in the container
int size();
```

You are given a file that has an unknown number of rows, and 4 columns of integers. Assume there are no malformed rows (ie != 4 columns). It looks like the following.

```
1,10,7,0
2,5,4 ,0
3,3,10,1
5,15,12,1
6,0,4,0
7,7,10,1
8, 1,19,1
9,1,6,1
```

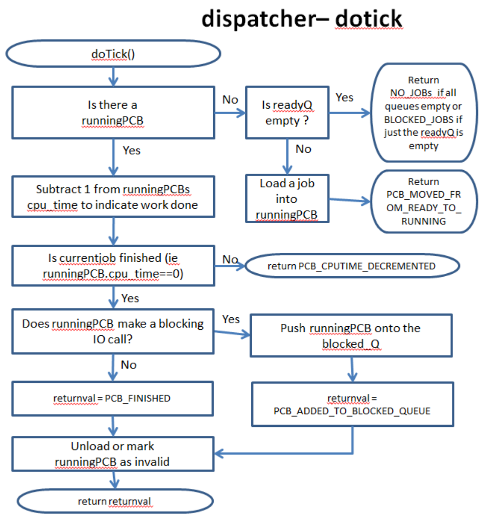
This file can have any name, but I will call it testdata.txt for the purposes of this document. The first column is process_number, second is start_time, third is cpu_time and the fourth is io_time.
File_IO provides functions to load this data into a vector and sort it.

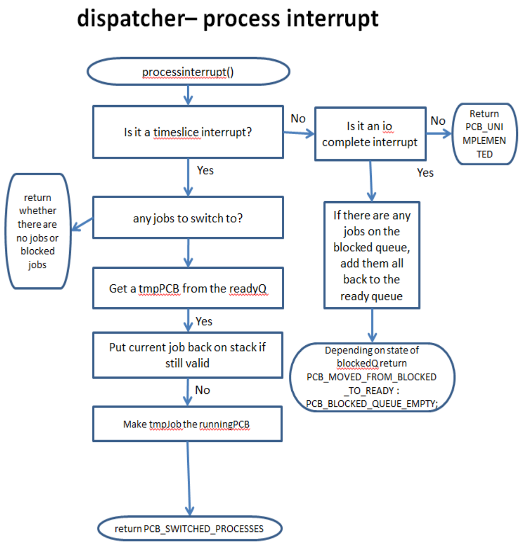
Job List

Job list uses File_IO to load the list of jobs to execute. Its purpose is to feed jobs to the dispatcher as they become available. You are given the header file.
Please provide an implementation in the joblist folder

Dispatcher

The algorithmic heart.   These flowcharts illustrates how its main functions should operate.


dispatcher– dotick
doTick()
Is there a runningPCB
No
Is readyQ empty ?
Yes
Return NO_JOBs if all queues empty or BLOCKED_JOBS if just the readyQ is empty
Yes
No
Subtract 1 from runningPCBs cpu_time to indicate work done
Load a job into runningPCB
Return PCB_MOVED_FROM_READY_TO_RUNNING
Is currentjob finished (ie runningPCB.cpu_time==0)
No
return PCB_CPUTIME_DECREMENTED
Yes
Does runningPCB make a blocking IO call?
Yes
Push runningPCB onto the blocked_Q
No
returnval = PCB_FINISHED
returnval = PCB_ADDED_TO_BLOCKED_QUEUE
Unload or mark runningPCB as invalid
return returnval


dispatcher– process interrupt
processinterrupt()
Is it a timeslice interrupt?
No
Is it an io complete interrupt
No
Return PCB_UNIMPLEMENTED
Yes
Yes
return whether there are no jobs or blocked jobs
any jobs to switch to?
If there are any jobs on the blocked queue, add them all back to the ready queue
Get a tmpPCB from the readyQ
Yes
Put current job back on stack if still valid
Depending on state of blockedQ return PCB_MOVED_FROM_BLOCKED_TO_READY : PCB_BLOCKED_QUEUE_EMPTY;
No
Make tmpJob the runningPCB
return PCB_SWITCHED_PROCESSES

runningPCB.Io_time can be 0 or 1 as defined in the testdata.txt file. If io_time==0 then the process has no io operations (fat chance in the real world). If io_time ==1 then the process will have one IO operation that requires it to be moved to the blocked queue. This occurs after the cpu_time has all been used. In other words, the cpu_time in decremented each tick count until it reaches 0, then if io_time is equal to 1, runningPCB is moved to the blocked queue (first set io_time=0) where it awaits an IO_interrupt. Once the interrupt happens it is moved back to the ready queue where it exits.
Please provide an implementation in the dispatcher folder

Output

The program prints a lot of info to the console to help you see what is happening.
The program also logs what process is executing during which tickcount, see ST_LOG at the end of Proj2_Main.cpp. I will use this output to gauge your programs accuracy. I will also use different test data than what I provided.

Documentation and Testing

Make sure you comment each function and the program as a whole. I recommend you test each module separately (which implies you write test code to verify its behavior).

Joblist should be relatively easy, it must load a file and sort the contents by start time, then when it's time to load a job it does so.

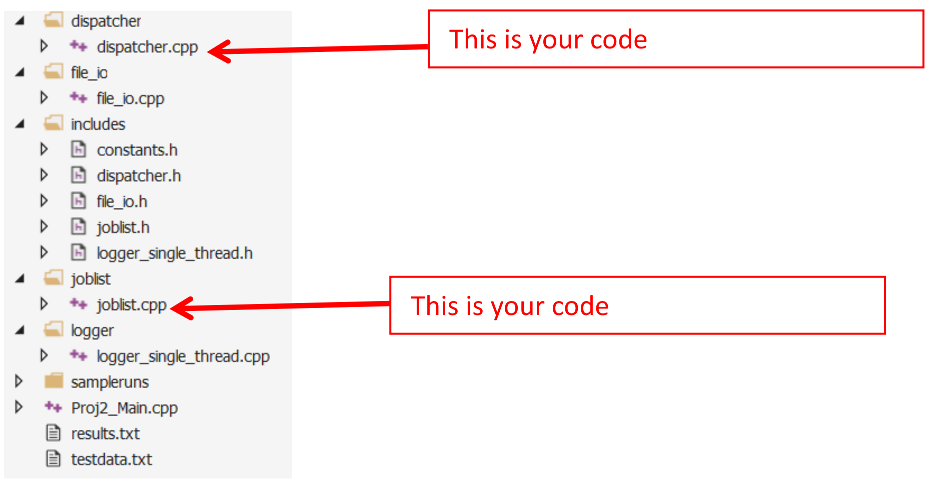
The dispatcher is harder: I recommend you start with simple data
1 process no IO
1 process with IO

2 processes no IO
2 processes with IO
Then many processes with a mix of IO and nonIO processes

To help you I have included several files with sample inputs and outputs, see sampleruns folder.
All were run with these defaults as defined in Proj3_SOL.cpp.

```
        const int      TIMESLICE = 4;
        const int      NUMBER_CYCLES_BETWEEN_IO_INTERRUPTS = 20;
```

Directory Structure



```
dispatcher
    dispatcher.cpp
file_io
    file_io.cpp
includes
    constants.h
    dispatcher.h
    file_io.h
    joblist.h
    logger_single_thread.h
joblist
    joblist.cpp
logger
    logger_single_thread.cpp
sampleruns
Proj2_Main.cpp
results.txt
testdata.txt
```

Grading

I will drop your dispatcher.cpp and joblist.cpp into the appropriate places in my project. Therefore these are the only files that I need from you.

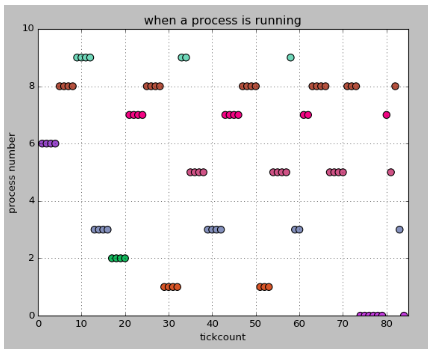
30% joblist.cpp works correctly
30% dispatcher correct without io blocking
40% dispatcher with io blocking

I use the output provided by the ST_LOG call in Proj2_Main.cpp to gauge your programs accuracy. I will also use different test data than what I provided as part of the project.

<u>This assignment is complex and is weighted 1.5 times the weight of project 1</u>

Do you want to display your data?

I've included a python program in the plotProcesses folder. Here is what results.txt plots to using this program. It helps to visualize whats going on with your program. Use it if you want.



APIs that may help

std::queue example

```
#include <queue>
std::queue<PCB> ready_Q;

//to add
ready_Q.push(myPCB);

//to remove
runningPCB = ready_Q.front();           //get its value
ready_Q.pop();                          //remove from queue
```