Assignment 3

Please complete a report and upload the corresponding codes.

The files should be uploaded directly without compression without compression without compression without compression

The files to be submitted for this assignment are:

1. report.pdf
2. ex1.zip
3. ex2.zip
4. ex3.zip

EX0. CPU Scheduling [25pts]

Consider the following single-threaded processes, and their arrival times, estimated CPU costs and their priorities (a process with a higher priority number has priority over a process with lower priority number):

Process	Estimated CPU Cost	Arrives	Priority
A	4	1	1
B	1	2	2
C	3	5	3
D	2	4	4

Please note:

- Ignore context switching overhead.
- If a process arrives at time x, they are ready to run at the beginning of time x.
- Highest response ratio next (HRRN) is a non-preemptive scheduling algorithm. In HRRN, the next job is not that with the shorted estimated run time, but that with the highest response ratio defined as: 1 + waiting time / estimated CPU time.
- Newly arrived processes are scheduled last for RR. When the RR quanta expires, the currently running thread is added at the end of to the ready list before any newly arriving threads.
- The quanta for RR is 1 unit of time.
- Average turn-around time is the average time a process takes to complete after it arrives.
- SJF is non_preemptive.
- Priority scheduler is preemptive.

Given the above information please fill in the following table.

Time	HRRN	FIFO/FCFS	RR	SJF	Priority
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
Avg. Turn-around Time					

EX1. Implement a syscall that can set the priority of current process [15pts]

We already add an integer named `labschedule_priority` which represents the priority of process in PCB. When the PCB initializes, the `labschedule_priority` will be set 1.

Please implement a syscall that can set the priority of current process (the priority is given). And you need to print some information like 'set priority to 5' after the priority are modified.

To test your code, you need to run user program `ex1`. Please release annotations in the main function in `ex1.c`. Other contents are prohibited to modify in `ex1.c`. And you should let user_main to run `ex1` instead of `rr`.

Tips:

syscall number is 255.

Some file that you probably need to modify:

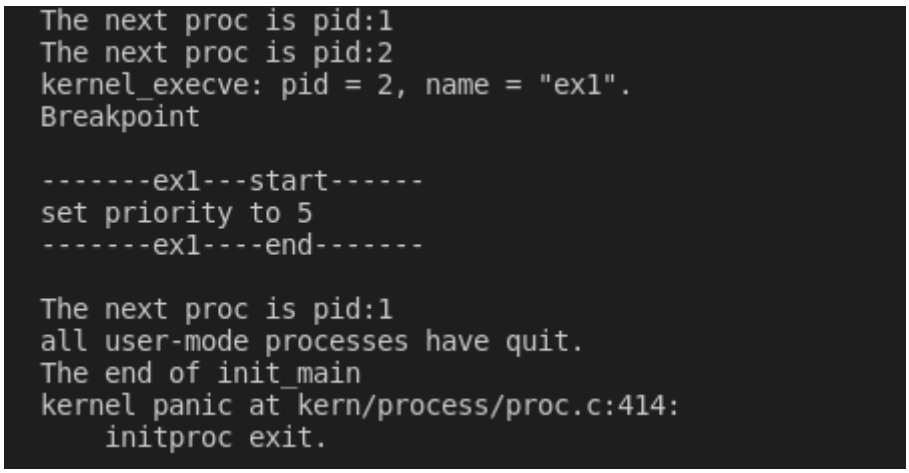
`ulib.c`, `syscall.c` in `/user/libs`

`unistd.h` in `/libs`

some files in `/kern/syscall` and `kern/process`

Please show your design idea, modified code(screen-shot) and the running result(screen-shot) in your report.

Sample:



EX2. the RR scheduling Algorithm based on Priority [20pts]

Please complete the ex2 based on ex1

In this week's lab, every child process get the same time slice. So, we want to set different time slices for different child process according to the priority. The child process that have high priority will get more time slices for each turn.

Please set the time slice to `max_time_slice* priority` when the child process **enqueue** the run queue. And you need to print the information of time slice to show your modification.

To test your code, you need to run user program `ex2`. Please release annotations in the main function in `ex2.c`. Other contents are prohibited to modify in `ex2.c`. And you should let user_main to run `ex2` instead of `rr`.

Please show your design idea, modified code(screen-shot) and the running result(screen-shot) in your report.

Sample:

```
pid:4 's time slice is 5
The next proc is pid:5
pid:5 's time slice is 20
The next proc is pid:6
pid:6 's time slice is 25
The next proc is pid:7
pid:7 's time slice is 10
The next proc is pid:3
pid:3 's time slice is 15
The next proc is pid:4
pid:4 's time slice is 5
The next proc is pid:5
pid:5 's time slice is 20
The next proc is pid:6
child pid 6, acc 4000001, time 5950
The next proc is pid:7
pid:7 's time slice is 10
The next proc is pid:3
pid:3 's time slice is 15
The next proc is pid:4
pid:4 's time slice is 5
The next proc is pid:5
child pid 5, acc 4000001, time 6410
The next proc is pid:2
The next proc is pid:7
pid:7 's time slice is 10
The next proc is pid:3
pid:3 's time slice is 15
The next proc is pid:4
pid:4 's time slice is 5
The next proc is pid:7
pid:7 's time slice is 10
The next proc is pid:3
pid:3 's time slice is 15
The next proc is pid:4
pid:4 's time slice is 5
The next proc is pid:7
pid:7 's time slice is 10
The next proc is pid:3
child pid 3, acc 4000001, time 7240
The next proc is pid:4
pid:4 's time slice is 5
```

EX3. Preemptive process scheduling [40pts]

In ex3, we will implement preemptive scheduling.

Please unable the clock interrupt first.

In PCB, we add another integer name `labschedule_good` and the initial number is 6. **You need to implement a syscall to let user process set `labschedule_good`.**

When the child process runs for a while, it may call the syscall to modify `labschedule_good`.

In this scheduling algorithm, we need to choose the process with the largest good value to run when scheduling.

That is to say, when a process call syscall to set its `labschedule_good` smaller, it will be preempted by a runnable process with a larger `labschedule_good`.

If processes have same `labschedule_good`, they are scheduled by fifo.

You need to realize this scheduling algorithm by modify `default_sche.c`.

To test your code, you need to run user program `ex3`. Please release annotations in the main function in `ex3.c`. Other contents are prohibited to modify in `ex3.c`. And you should let user_main to run `ex3` instead of `rr`.

Please show your design idea, the running sequence of processes, modified code(screen-shot) and the running result(screen-shot) in your report.

Sample:

```
main: fork ok,now need to wait pids.
The next proc is pid:3
set good to 3
The next proc is pid:4
set good to 1
The next proc is pid:5
set good to 4
The next proc is pid:6
set good to 5
The next proc is pid:7
set good to 2
The next proc is pid:6
child pid 6, acc 4000001
The next proc is pid:2
The next proc is pid:5
set good to 4
child pid 5, acc 4000001
The next proc is pid:2
The next proc is pid:3
set good to 3
child pid 3, acc 4000001
The next proc is pid:2
The next proc is pid:7
child pid 7, acc 4000001
The next proc is pid:2
The next proc is pid:4
child pid 4, acc 4000001
The next proc is pid:2
main: wait pids over
The next proc is pid:1
all user-mode processes have quit.
The end of init_main
kernel panic at kern/process/proc.c:414:
    initproc exit.
```