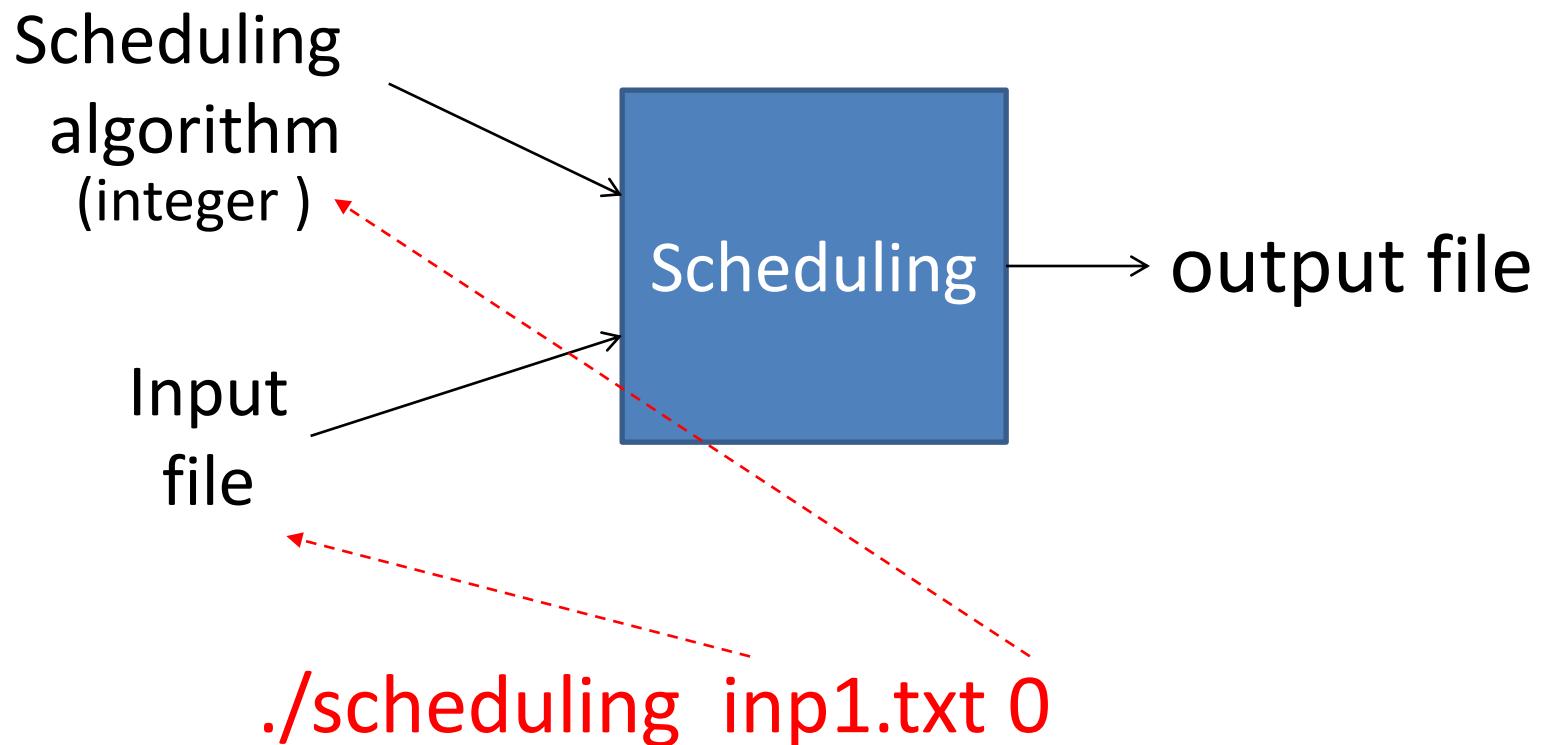


OS Scheduling

What Will We Do?

- In this project we will test several scheduling algorithm



Your Source Code

- scheduling.c
- compile with:

gcc -Wall -o scheduling -std=c99 scheduling.c

Input File

- The first line in the file is the total number of processes.
- Each process will be represented by 4 numbers:

A B C D:

- A: process ID
- B: CPU time
- C: I/O time
- Arrival time

Note: If more than one processes arrive at the same time, give preference to the one with lower ID.

0.5 CPU time	I/O time	0.5 CPU time
--------------	----------	--------------

How time is distributed for a process

Note: We will use integers, not floating points.
In case $(0.5 * \text{CPU Time})$ is float, round to following cycle (e.g. if cpu time is 7 then $7/2 = 3.5 \rightarrow 4$).

All times are in cycles

Scheduling Algorithms

- 0: First-Come-First-Served (**nonpreemptive**)
 - Queue of ready processes
 - Newly arriving processes are added to the end of the queue.
 - When a process is blocked, due to I/O, and then becomes ready, it is added to the end of the queue.
 - If two processes happen to be ready at the same time, give preference to the one with lower ID.

Scheduling Algorithms

- 1: Round-Robin with quantum 2
 - Another process scheduled if one of the following occurs:
 - Current running process terminates
 - Current running process is blocked on I/O
 - Current running process ran for 2 cycles
 - You can think of RR as a queue of ready processes. When a process goes from running to ready, it moves to the back of the queue.
 - If two processes become Ready at the same time, give preference to the one with smaller ID

Scheduling Algorithms

- 2: Shortest remaining job first (**preemptive**)
 - At each cycle, you calculate the **remaining CPU time** for all **ready/running** processes and run the one with shortest reaming time
 - If several processes have the same remaining CPU time, give preference to the process with lower ID.

Output

- You output a file with name: `inputfilename-s.txt`
 - `inputfilename` is the name of the input file without the extension
 - `s` is the scheduling algorithm: 0, 1, or 2
 - Example: if input file is `inp1.txt`, your output file for FCFS shall be: `inp1-0.txt`
- Your output file has two parts
 - Timing snapshot (**starting from cycle 0**)
 - Statistics

Output

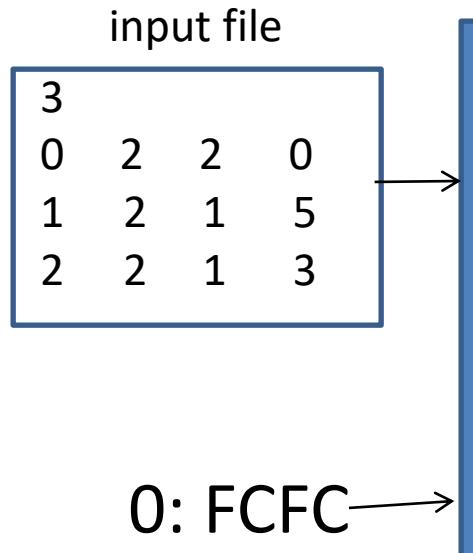
- Timing snapshot: at every line show:
 - Cycle time
 - State of each process (**running**, **ready**, or **blocked**)
 - example: 1:blocked (i.e. process 1 is in blocked state)
 - Print processes ordered by their process ID
 - **Be careful:** do not show processes that have not yet arrived, or those that have terminated.
- Statistics:
 - Finishing time (i.e. last cycle)
 - CPU utilization (#cycles CPU was doing work / total number of cycles)
 - When there is a cycle where none of the processes is running, then the CPU is considered idle.
 - For each process:
 - Turnaround time (i.e. cycle this process finished – cycle it started + 1)

Example

# processes	input file			
3	0	2	2	0
	1	2	1	5
	2	2	1	3

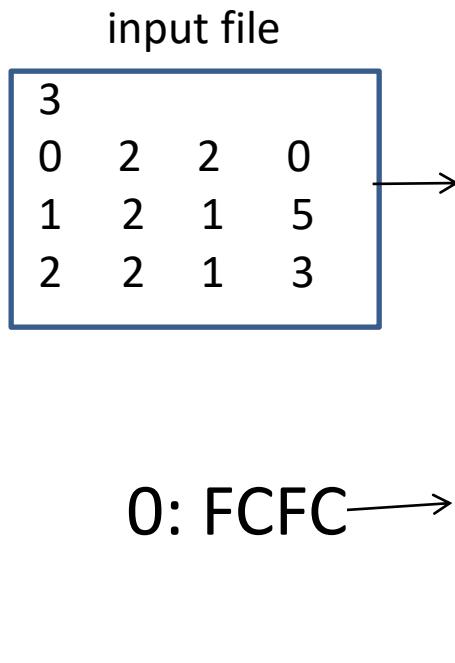
Process ID CPU Time I/O Time Arrival Time

Example



0 0:running
1 0:blocked
2 0:blocked
3 0:running 2:ready
4 2:running
5 1:running 2:blocked
6 1:blocked 2:running
7 1:running
(empty line)
Finishing time: 7
CPU utilization: 0.625
Turnaround process 0: 4
Turnaround process 1: 3
Turnaround process 2: 4

Example



Clock cycle
State of each process

0 0:running
1 0:blocked
2 0:blocked
3 0:running 2:ready
4 2:running
5 1:running 2:blocked
6 1:blocked 2:running
7 1:running
(empty line)
Finishing time: 7
CPU utilization: 0.625
Turnaround process 0: 4
Turnaround process 1: 3
Turnaround process 2: 4

The text on the right side provides the results of a scheduling algorithm. It includes a header "Clock cycle" and "State of each process". Below this, it lists the state of each process at each clock cycle. For example, at cycle 3, process 0 is running and process 2 is ready. The text also includes the finishing time (7), CPU utilization (0.625), and turnaround times for each process (0: 4, 1: 3, 2: 4). A red oval highlights the entry for clock cycle 3, and a red arrow points from the label "State of each process" to this highlighted entry.

What To Submit

Your source code: single file with the name
scheduling.c