Exam 1 preview

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What will be covered?

Intro

OS intro
Linux and shell
Comp. architecture

bash

how bash works
files and dirs
running commands
scripting

proc. mgmt.

processes (OSTEP 4)
C process API (5)
direct execution (6)
proc. scheduling (7)
MLFQ (8)

Amount of coverage on test will roughly
reflect amount of coverage in class

You are responsible for material in text
even if not discussed in class.

Exam format

45 minute exam

No notes allowed

Many multiple-choice and fill-in-the-blank

Some bash and C coding questions

- most will ask you to provide 1 or 2 lines of code

I expect you to understand OSTEP
simulators used in lab and homework

How to prepare

Answer lab questions.

Answer homework problems.

Answer questions asked during lectures.

Use the flash cards I provided, or your own.

https://www.cram.com/flashcards/bash-practice-6518378

Write down definitions or explanations for all concepts we've covered.

Use Peerwise.

Quiz yourself!

Intro material

OS intro

What are some design goals of operating systems?

- ☐ provide convenient abstractions to users and programmers

- ☐ protect the system from bad programs

- ☐ protect programs from bad programs

- ☐ low overhead

- ☐ support multi-programming

- ☐ security and privacy

Linux and shell

Is 'ls' part of the Linux kernel?

No.

It's part of GNU coreutils.

Computer architecture

What are the three top-level components of a computer?

Processor

Storage (including RAM)

I/O

Computer architecture

About how long does it take to access a file stored on a hard drive?

250 ns

100 microseconds

10 ms

0.2 seconds

Bash

how Bash works

At the bash command prompt, write what you'd enter to see the number of lines in file foo.txt.

$ wc –l foo.txt

how Bash works

At the bash command prompt, write what you'd enter to get information about the 'man' command.

$ man man

Bash, files and directories

At the bash command prompt, write what you'd do to copy file 'files.tar' to your home directory (don't use the absolute pathname of your home directory)

$ cp files.tar ~

Bash, files and directories

what does this do?

$ cd ../..

Changes working directory to the parent of the parent directory.

Bash, files and directories

At the bash command prompt, write what you'd do to see the first five lines of file 'baz'

$ head -5 baz

Bash, files and directories

At the bash command prompt, write what you'd do to delete directory 'faces' (in the current directory) and all files and directories "below" it.

$ rm –r faces

Bash, commands

What environment variable does bash use to look for commands?

PATH

Bash, commands

What would you enter to discover the file location of the command 'tar' that bash would use?

$ which tar

Bash, commands

Which bash variable can you use to find the exit status of a command?

?

for example:

```
$ echo $?
```

Bash commands

delete all files in the current directory ending with .c

```
rm *.c
```

Bash commands

Using octal mode give directory 'mystuff' (in the current working directory) the following permissions:

- ☐ owner can read, write, and execute

- ☐ group can read and execute

- ☐ others can read and execute

```
chmod 755 mystuff
```

Bash, commands

Fill in the blank to give a loop that will show the last line of files foo1.txt, foo2.txt, foo3.txt in the current working directory.

```
for f in _____

do

    tail -1 $f

done
```

Bash, commands

Enter the bash command you would use to find the processes that are consuming the most system resources?

$ top

Bash, scripts

The last line of the bash code below causes an error to happen. What went wrong?

```
$ cat temp
$ #!/bin/bash
$ echo $USER
$ ls –l temp
-rw-r--r--. 1 brun1992 shell_faculty 23 Sep 15 15:10 temp
$ ./temp
```

http://pages.cs.wisc.edu/~remzi/OSTEP/

1. the file needed a '.exe' suffix
2. there is no USER variable
3. the file did not have correct permission

Tar

create a tar file all-txt.tar from all the .txt files in the
current working directory

```
tar cf all-txt.tar *.txt
```

Process management

Proc. Mgt., C process API

What does a 'fork' return value of 0 signify?

1. fork error
2. process to which this value is returned is the child process
3. process to which this value is returned is the parent

Proc. Mgt., limited direct execution

One idea for how to support multi-programming is to ask programs to yield control to the OS every so often.

Which OS design goals is this approach in conflict with? (select all that apply)

1. provide convenient abstractions
2. protect programs from other programs
3. provide fair sharing of resources

what about 1?

Proc. Mgt., limited direct execution

T/F Can privileged CPU instructions be run in kernel mode?

Yes

Proc. Mgt., limited direct execution

Name a hardware ingredient that an OS needs to support effective multi-programming.

timer interrupts

Proc. Mgt., process scheduling

Assume 3 jobs arrive at the same time, with run times 20 seconds, 10 seconds, and 30 seconds. If they are run in the listed order, what is the <u>average turnaround time</u>?

| 20 | 10 | 30 |

```
0            20    30                    60
```
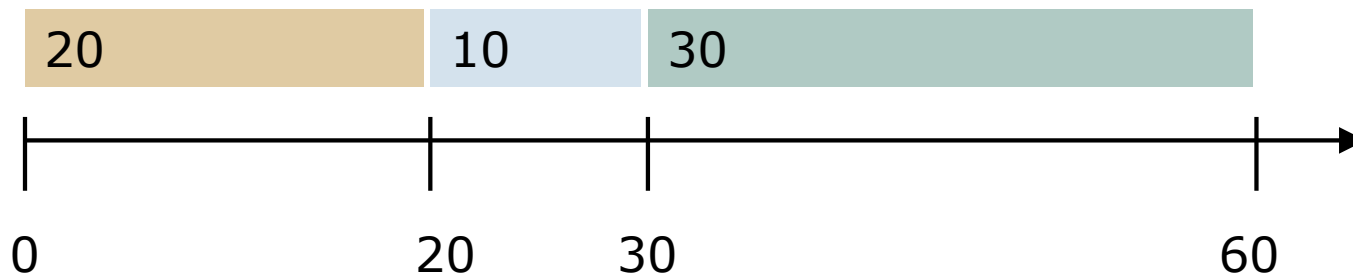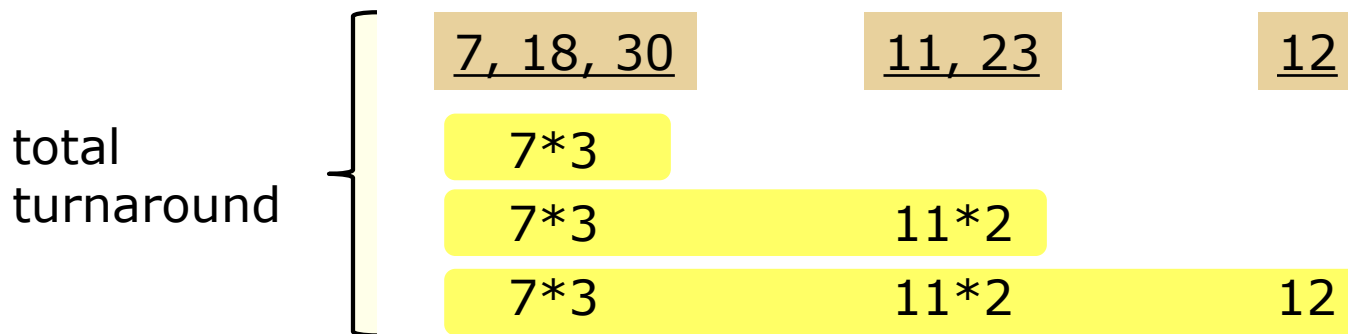
Proc. Mgt., process scheduling

Assume 3 jobs arrive at the same time, with run times A seconds, B seconds, and C seconds. If they are run in the listed order, what is the <u>average response time</u>?

Proc. Mgt., process scheduling

Assume 3 jobs arrive at the same time, with run times 20 seconds, 10 seconds, and 30 seconds. If they are run using <u>round robin</u>, what is the <u>average turnaround time</u>?

Another way to calculate round robin

Assume 3 jobs arrive at the same time, with run times 18 seconds, 7 seconds, and 30 seconds. If they are run using <u>round robin</u>, what is the <u>average turnaround time</u>?

total turnaround

| <u>7, 18, 30</u> | <u>11, 23</u> | <u>12</u> |

7*3

7*3   11*2

7*3   11*2   12

total turnaround is 7*3*3 + 11*2*2 + 12 = 119

avg. turnaround = 119/3

Proc. Mgt., process scheduling

Assume you use STCF to process 3 jobs:

	arrival time	job duration
A	0	50
B	10	25
C	15	70

What is average response time?

What is average turnaround time?

Which job has the longest response time?

Proc. Mgt., process scheduling

Be able to answer these kinds of questions for all kinds of scheduling:

- SJF

- FCFS

- Round Robin

- STCF

Round robin is the trickiest

MLFQ

In basic MLFQ, what happens to a job that gives up CPU before the end of its time slice?

1. its priority is increased
2. its priority is decreased
3. its priority stays the same

Bonus content: some terms to know

- bus
- storage hierarchy
- heap
- process
- file descriptor
- process state
- multi-programming
- forking a process
- process tree
- time slice (aka quantum)
- user mode, kernel mode
- privileged instruction
- interrupt
- interrupt handler

- trap
- turnaround time
- response time
- SJF, STCF, FCFS
- round robin
- context switch
- MLFQ, boosting
- process starvation
- gaming the system
- I/O bound, CPU bound