

Answers on Signals, Pipes, Redirections

When a hardware interrupt happens, a process may go from blocked to ready state. [T/F]
(multiple choice question with SINGLE correct answer)

- C. Correct. True
- D. Incorrect. False

Explanation: This is true because a hardware interrupt may mean the completion of some external I/O operations, which unblocks a process.

Which of these examples can cause a hardware interrupt? Select all that apply.
(multiple choice question with multiple correct answers)

- A. Correct. Clock tick or pulse
- B. Correct. Completion of disk operation
- C. Correct. Network message has arrived
- D. Correct. Illegal memory access by user level process

As discussed in the video. These external events generate hardware interrupts that cause the operating system to react.

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As discussed in the video. These external events generate hardware interrupts that cause the operating system to react.

Which of the following correctly contrasts interrupt handlers and system calls? Select all that apply.

(multiple choice question with MULTIPLE correct answers)

- A. Correct. System calls have return values while interrupt handlers do not.
- B. Incorrect. Context switch happens for system calls but not interrupt handlers.
- C. Correct. Both interrupt handlers and system calls require context switching.

Interrupt handlers have parameters used by the OS, but no return values that are relevant to the user. Both system calls and interrupts are handled in kernel mode.

Is the following statement true or false? Select the best answer.

Custom handlers are code in user space written to process signals sent to a process.

- A. Correct. True
Every signal results in a default processing behavior, unless the user registers a custom handler in their code in user space.
- Incorrect. False

Is the following statement true or false? Select the best answer.
All signals from one process to another goes through the kernel.

A. Correct. True

The operating system has a software component for doing signal relaying, because the operating system does not want to allow a process to send arbitrary signals to another process. The operating system essentially serves as a gatekeeper for all signals.

Incorrect. False

Is the following statement true or false? Select the best answer.
Signals that are blocked by the operating system are lost forever.

A. Incorrect. True

B. Correct. False

If a signal reaches this filter and it's slated to be blocked, then the signal will be buffered within the operating system. When there is an explicit command to unblock the signal, it will be relayed to the process.

Interrupts are only initiated by currently running processes.
(multiple choice question with SINGLE correct answer)

A. Incorrect. True

B. Correct. False

Interrupts can be initiated by hardware, e.g. clock ticks, completion of I/O requests.

Blocked signals are lost permanently.
(multiple choice question with SINGLE correct answer)

A. Incorrect. True

B. Correct. False

Blocked signals are buffered, and not lost.

Which of the following is not an example signal that originates from a hardware interrupt?

A. Incorrect. Clock pulse for updating system time

Clock pulse is a hardware signal since it originates from some change(s) in hardware that result in signals being sent.

B. Incorrect. Input from keyboard, network, or disk

Input from keyboard, network, or disk are hardware signals since it originates from some change(s) in hardware that result in signals being sent.

C. Incorrect. Illegal memory access

Illegal memory access is a hardware signal since it originates from some change(s) in hardware that result in signals being sent.

D. Correct. SIGINT signal from one process to another

SIGNIT is a software signal from one process to another.

Is the following statement true or false? Select the best answer.
STDIN and STDOUT are file descriptors made available to a process.
(multiple choice with SINGLE correct answer)

A. Correct. True

B. Incorrect. False

STDIN and STDOUT are reserved as file descriptors which by default read from keyboard and output to the terminal. However, they can be overwritten.

Consider a command `pwd < out`, where `out` is a valid text file, and `pwd` prints the current path. When you type it in a shell, what is the expected output? Select the best answer.

- A. Incorrect. Prints the contents of `out`
- B. Incorrect. Invalid command
- C. Correct. The shell ignores `out` and just prints the current path

Since `pwd` is not expecting a STDIN, the '`< out`' is ignored by shell.

Suppose you have a command that takes in an argument (e.g. `sleep()`) and you run "`sleep 10 < file.txt`". When you type it in a shell, what is the expected output if the contents of `file.txt` is "`100`" and nothing else? Select the best answer.

- A. Correct. Sleeps for 10 seconds
- B. Incorrect. Invalid command
- C. Incorrect. Sleeps for 100 seconds

The system call for `sleep` is not expecting another input argument, so the redirection is irrelevant and gets ignored.

What is the output of `ls | pwd`? Select the best answer.

- A. Incorrect. We list all files in the current directory, and `pwd` is ignored.
- B. Incorrect. Throws an error
- C. Correct. The current path is printed out.

The two commands run concurrently, but since the output of `ls` is used as input to `pwd`, it is not displayed. However, since `pwd` does not read from standard in, the output of `ls` is ignored and only the `pwd` command is executed.

What is the behavior of `ls | more > out`? Select the best answer.

- A. Incorrect. `ls` runs to list all the directories. If more than fit into a page, the user has to press space to continue until all the files are listed. The output is stored in the file `out`.
- B. Correct. `ls` runs to list all directories. Even if more than a page is needed, the user does not press any keys, and all the listed files are stored in the file `out`.
- C. Incorrect. Throw an error.

This is somewhat surprising. Since the output of `ls` goes to a file, there is no real definition of a screenful of display, hence no user keys are needed.

Is the following statement true or false? Select the best answer.

A `ctrl-C` signal will be sent to an entire process group.

- A. Correct. True
- B. Incorrect. False

Answer: True. By definition, the option of grouping processes together allow us to send a signal to all.

Is the following statement true or false? Select the best answer.
A pipeline of processes A | B | C are in the same process group.

A. Correct. True

B. Incorrect. False

Whenever a pipeline of processes is implemented, the OS will always group the processes together so that they can receive common signals at the same time.

Which of the following commands are illegal or will cause the process to be stopped? Select the best answer.

A. Incorrect. `ls > out`

B. Incorrect. `ls > out &`

C. Correct. `cat &`

D. Incorrect. `ls | pwd &`

C is illegal since a process cannot take in standard input in the background. Interesting, most OS will allow b to happen. It just becomes distracting to have background processes generating output in the background.

Is the following statement true or false? Select the best answer.

When a process is stopped, a SIGCHLD signal is sent to the parent.

A. Correct. True

B. Incorrect. False

Whenever a process is stopped or exited, a SIGCHLD signal is sent to to the parent