Eddy Qiang
3005819
T05

1. a) total time = fetch + decode + execute
= 6 + 4 + 2
= 12 nsec
instructions per second = 1 sec / 12×10^{-9}
= 83333333 instructions per second

b) When stages are operating in parallel, it would take as much time as the slowest stage, so it would be the fetch stage.
instructions per second = 1 sec / 6×10^{-9}
= 166666666 instructions per second

2. a) One benefit of using VM for a company is reduced hardware costs. You can run multiple virtual machines on a single physical server.

b) One benefit of using VM for a programmer is that you can program in different operating system environments without having multiple computers or having to create a separate partition on your harddrive.

c) One benefit of using VM for a regular user is they can run programs that are not cross compatible across operating systems. For example a user can play android games on their windows PC.

d) One benefit of using VM for system administrators is increased efficiency and productivity. You can operate and manage multiple operating system instances at once on a single physical server.

Hilroy

3. a) An interrupt is a signal sent to the processor notifying it that an event needs to be handled. The current code execution will be suspended until the interrupt handler deals with the event.

b) A trap is a type of interrupt caused by an exceptional condition. The OS will be switched to kernel mode to perform some action before returning control to the originating process.

c) The difference is that interrupts are handled asynchronously, they do not happen in predictable places. While traps handling is synchronous, usually the code expects traps to happen.

d) Interrupts and traps are handled in kernel mode instead of user mode because in kernel mode the executing code has complete and unrestricted access to hardware. It can execute any instruction whereas in user mode you cannot.

4. a) time ./cantLines
real 0m0.069s
user 0m0.009s
sys 0m0.060s

time wc -l
real 0m0.003s
user 0m0.000s
sys 0m0.003s

b) c++ program
kernel mode: 0.060s
user mode: 0.009s

wc program
kernel mode: 0.003s
user mode: 0.000s

c) The 'wc' program is faster because it has fewer system calls, where as the c++ program has many as it reads one at a time.

5. real 0m0.003
user 0m0.002
sys 0m0.001

Mytime is faster than c++ program and smaller to 'wc'.