

Assume that three I/O devices are connected to a 32-bit, 10 MIPS CPU. The first device is a floppy drive with a transfer rate of 25 KB/sec over a 16-bit bus. The second device is a keyboard that must be polled thirty times per second. The third device is a hard drive with a maximum transfer rate of 1 MB/sec . It has a 32-bit bus. Assuming that the polling operation requires 20 instructions for each I/O device, determine the percentage of CPU time required to poll each device.

Floppy disk: $\frac{25 \text{ KB}}{(32/16)} = 12.5 \text{ KB} \Rightarrow 12.5 \times 2^{10} \text{ half words / second}$

Polling op = 20 instr $\Rightarrow 12.5 \times 2^{10} \times 20 = 256,000 \frac{\text{instr}}{\text{sec}}$

$$\frac{0.256 \times 10^6}{10 \times 10^6} = \boxed{2.56\%}$$

Keyboard: $30 \times 20 = 600 \frac{\text{instr}}{\text{sec}}$ $\frac{600}{10 \times 10^6} = \boxed{0.006\%}$

Drive: $1 \text{ MB} = \frac{2^{20}}{2^8} \Rightarrow 2^{12} \frac{32\text{-bit words}}{\text{sec}}$

$$20 \times 2^{12} = 5,242,880 \frac{\text{instr}}{\text{sec}}$$

$$\% = \frac{5.24288}{10} = \boxed{52.42\%}$$