Operating Systems
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S09

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Exercise 2

$$100MHz = 100 \cdot 10^6 Hz \rightarrow 10^8 \text{ times per second, 32 bits goes through the bus}$$
$$10^8 \cdot 4 = 4 \cdot 10^8 \text{ bytes/s} = 400 \text{ Mbytes/s}$$
$$\text{DMA transfer rate} = 40 \text{ Mbytes/s}$$

For every second, the DMA used $400/40 = 10$. The DMA reduced the transfer of instructions by 10%.

Exercise 3

Table 1: Advantages and disadvantages of placing functionality in device controller rather than directly in the kernel.

Advantages
Reduce the system's workload
Compilation target is known so we can optimize for the hardware
Kernel is smaller and could contains less bugs
Device is separated from the kernel, so error won't cause the whole system to fail

Disadvantages
Can slow down the system if this one is idle
Firmware has to be updated by hand (in most case)
Can't easely modify the firmware
Depending on the device we use, the implementation could be awful

Exercise 4

A character device driver is one that transfers data directly to and from a user process. A block device is accessed by block of data, provide buffered access to hardware devices, and provide some abstraction from their specifics.

Network device are none of them, such a device have some specific interface to the kernel w.r.t. packet transmission. A network device does not implements the classis *read* and *write* operations.
Yes, a file systems is mount logically and then multiple block devices could be used to map the data.

Exercise 5

Assuming the *acquire* function is blocking until the mutex is acquired, the following implementation prevent deadlocks.

```
void transaction(Account from, Account to, double amount)
{
    mutex lock1, lock2;
    lock1 = get_lock(from);
    lock2 = get_lock(to);

    acquire(lock1);
    withdraw(from, amount);
    release(lock1);

    acquire(lock2);
    deposit(to, amount);
    release(lock2);
}
```