HOMEWORK 8 Solution

Problem 1:

```
.orig x3000

        LEA R0, Text
        PUTS
        HALT

Text    .STRINGZ "\"This is the first question of the last homework! \""
.end
```

Problem 2:

Processing in asynchronous world is controlled by handshaking. It takes place when the processor accesses a I/O device or there is a communication between two other devices. Since it is unlikely that the devices in communication share a common clock, there needs to be a mechanism to synchronize them. Handshaking serves for his purpose.

Problem 3:

Polling the device usually means reading its status register every so often until the device's status changes to indicate that it has completed the request. So to keep from having to **busy-wait** all the time, **interrupts** are provided which can interrupt whatever is happening so that the processor can do some task and return to what it was doing without losing information.

An interrupt driven I/O is one where the I/O device will cause a hardware interrupt to occur whenever it needs to be serviced. In interrupt-driven approach, processor cycles are not wasted in just checking the status register again and again.

Problem 4:

Memory-mapped I/O uses a section of memory for I/O. The idea is simple. Instead of having "real" memory at that address, place an I/O device.

Thus, communicating to an I/O device can be the same as reading and writing to memory addresses devoted to the I/O device. The same data movement instructions LOAD and STORE can be used to access the I/O devices.

Special I/O instructions need expansion of instruction set. Instructions like IN and OUT has to be added which are used to put data to and get data from the I/O devices.

LC-3 uses memory-mapped I/O as you would have known.

Problem 5:

Solution available on the course web page.

http://pages.cs.wisc.edu/~david/courses/cs252/Spring2009/includes/handouts/main.asm