07.04.2018

Istanbul Technical University
Department of Computer Engineering

BLG 322E – Computer Architecture
Assignment 3

Due Date: 18.04.2018, **Wednesday,** 22.00.

QUESTION:

A CPU with 8-bit data bus, has an Interrupt Request input (**IRQ**) and an Interrupt Acknowledgement output (**INTA**). Both signals are active at "1". If the vectored/autovectored input (**VA**) of the CPU is "0", the CPU works with vectored interrupts, so that it reads the interrupt vector number after the acknowledgement of the interrupt, when it's Data acknowledgement input (**DACK**) is "1". The CPU also supports autovectored interrupts. After the acknowledgement of an interrupt request (**INTA=1**) if the vectored/autovectored input (**VA**) of the CPU is made "1", then it does not read a vector number and works in autovectored mode.

In this system there four interrupt sources (*A1*, *A2*, *B1*, *B2*) of two different types (*A*, *B*).

- Type **A**: These devices (A1, A2) have an Interrupt Request output (**IRQ**) and an Interrupt Acknowledgement input (**INTA**). They don't have a vector number outputs. They work in autovectored mode.

- Type **B**: These devices (B1, B2) have an Interrupt Request output (**IRQ**), an Interrupt Acknowledgement input (**INTA**), and 8-bit vector number output (**VN**).

Priority (precedence) order of the devices: *A1* > *A2* > B1 > *B2* (**Read carefully!**)

a) Design and draw the system with the CPU, 4 devices (*A1*, *A2*, *B1*, *B2*) and the priority interrupt controller. First, show the priority interrupt controller only as a box. Then design and draw the internal structure of the priority interrupt controller using logical gates.
b) Assume that the devices *A1* and *B1* assert their interrupt requests at the same time. Show step by step all the signals that are sent in the system until the requests of both devices has been fulfilled.
c) How does the CPU determine the start address of the interrupt service routine to be run if the interrupt source is a device of type ***A*** or of type ***B*** ?

Submission: Draw the diagrams using a computer program or by hand using a ruller. Name all inputs and outputs of the devices. You should type your name and student ID at the top of the paper. You must submit your homework in PDF format through the Ninova system before the due date. Late submissions are not accepted.

Assignments have to be made individually. If any plagiarism issue is detected, disciplinary regulations of the university are applied.

Note: If you have a problem about the homework, you may make contact with the responsible research assistant of the assignment (turkmenogluc@itu.edu.tr).