

Midterm Exam, Fall 2002, October 22

97.461: Microprocessor Systems

Department of Electronics, Carleton University

Instructor: Maitham Shams

Name: _____

Aids: All Allowed

ID: _____

Duration: One hour

Mark: out of 50

[1] (4 marks) What are the two major inventions responsible for changing the world of computing into *what we see today* (after mechanical and electric-motor-based computers.)

[a] *Transistor*

[b] *Integrated Circuits*

[2] (4+4=8 marks) In intel family of microprocessors,

[a] is it possible to have two different instructions for the same machine code? Why or how?
No, because this implies that one machine code performs two different tasks.

[b] is it possible to have two different machine codes for the same instruction? Why or how?
Yes, there is no harm in having two machine codes for the same instruction. In intel family this may be done by changing the "D" bit in an instruction and swapping the source and destination fields.

[3] (4+4=8 marks) You have 1 GB of data that you would like to put in a memory segment of an Intel 80386 microprocessor starting at location 10000000 (H).

[a] What are the 32-bit base, 20-bit limit, and G-bit values of the descriptor?
Since data is larger than 1 MB, we have to set G=1; this will append the limit by FFF (H). Thus, a 20-bit limit of 3FFFF is sufficient. The actual limit in this case will be 3FFFFFFF, which is 1 GB.

[b] At what memory location your data ends? At what memory location your memory segment ends?
The end location of the data and the limit are the same when using the above values: 10000000 + 3FFFFFFF = 4FFFFFFF

[4] (4+4=8 marks) In an Intel 8086 microprocessor, assume SS=1000 (H) and SP=0100 (H).

[a] How many additional bytes of data you can put into stack until it is full?

100 (H) = 256 Bytes

[b] After the stack gets full, where does an extra byte pushed into the stack will be saved? give the physical address.

Stack is cyclic. So SP will become FFFF after hitting zero. The physical address of the additional data then, is $10000 + FFFF = 1FFFF$.

[5] (2+2=4 marks) Explain why DRAMs need refreshing cycles? Which type of memory retains data even without a power supply connection?

DRAMs are dynamic digital circuits that hold data on parasitic capacitances. Since these capacitances leak, they need to be refreshed with data.

ROM type of memories like PROM, EPROM, and EEPROM retain data without supply connection.

[6] (18 marks) For an 8080 microprocessor (i.e. 20-bit address bus and 8-bit data bus), use the NAND-gate technique (only NAND gates and inverters allowed) to map the upper most eighth ($\frac{1}{8}$) of the memory (ending at FFFFF) into four identical EPROM chips. Find out the size of the suitable EPROM chips. Draw the circuit and indicate the start and the end addresses accessible through each EPROM. Use the \overline{RD} and $\overline{IO/\overline{M}}$ control signals of the microprocessor to access memory.

