ANNOUNCEMENTS

- No labs this week (except for B5)
- Lab 2 Part 2 due next week in lab
  - Week of October 11th

- Lab 3 will start week of October 11th
- Exam 2 – Friday, October 22nd in lecture
MACHINE INSTRUCTIONS

- CPU processes instructions and controls what the computer does.

- The instructions are referred to as machine instructions and are written in machine language.

TYPES OF MACHINE INSTRUCTIONS

- Data Transfer
Types of Machine Instructions

- Arithmetic/Logic

Types of Machine Instructions

- Control
ARCHITECTURE OF AN EXAMPLE MACHINE

- 16 general purpose registers
  - Addressed 0-15

- 256 main memory cells
  - Addressed 0-255

DECODING INSTRUCTIONS

- Instructions contain two parts:
  - Op-code (operation code)

  - Operand
Example Instruction

Op-code | Operand
-------|--------
0011   | 0101   | 1010 | 0111
3       | 5      | A    | 7

Actual bit pattern (16 bits)

Hexadecimal form (4 digits)

Decoding Instructions

9 F A 6

Exclusive or

Registers that store the information on which we will perform the operation

Register to store the result
EXAM 2 STUDY QUESTIONS

- Section 2.2 – page 91
  - 3
  - 5
  - 7

MACHINE CYCLE

- Fetch
- Decode
- Execute
SAMPLE PROGRAM EXECUTION

Program counter contains address of first instructions.

CPU

Main memory

<table>
<thead>
<tr>
<th>Address</th>
<th>Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>13</td>
</tr>
<tr>
<td>A1</td>
<td>23</td>
</tr>
<tr>
<td>A2</td>
<td>1C</td>
</tr>
<tr>
<td>A3</td>
<td>46</td>
</tr>
<tr>
<td>A4</td>
<td>75</td>
</tr>
<tr>
<td>A5</td>
<td>30</td>
</tr>
<tr>
<td>A6</td>
<td>35</td>
</tr>
<tr>
<td>A7</td>
<td>95</td>
</tr>
<tr>
<td>A8</td>
<td>C0</td>
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</table>

Program is stored in main memory beginning at address A0.
SAMPLE PROGRAM EXECUTION

Program counter contains address of first instructions.

CPU

Registers

0
1
2
...
F

Program counter

Instruction register

Main memory

Address

Cells

A0 13
A1 23
A2 10
A3 46
A4 75
A5 30
A6 35
A7 95
A8 C0
A9 00

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SAMPLE PROGRAM EXECUTION

Program counter contains address of first instructions.

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Registers

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Program counter

Instruction register

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Program is stored in main memory beginning at address A0.
SAMPLE PROGRAM EXECUTION

Program counter contains address of first instructions.

Cpu

Registers
0
1
2

Instruction register

Main memory
Address Cells
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A2 10
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Program is stored in main memory beginning at address A0.

Sample Program Execution
Exam 2 Study Questions

- Section 2.3 – page 98
  - 1
  - 2

Operating Systems

- Complex pieces of software that helps to control all of the activities of the computer.
**Job Scheduling**

- Jobs are the programs/activities to be executed by the computer.

**Types of Software**

- Application Software
- System Software
SHELL

KERNEL
- File manager
- Device drivers
- Memory manager
QUESTION

- What happens when you turn on the power to the computer?

BOOTING

- Initial instructions store in ROM.
PROCESS MANAGEMENT

- A process is the activity of executing a program.
- Each process is recorded in a process table with its process state.

SCHEDULING PROCESSES

- A process can be in two states:
  - Ready
  - Waiting
SCHEDULING PROCESSES

- Machine’s processing time divided into short segments called time slices.

- During each time slice, a ready process runs.

- When the time slice is over, the process that is running is interrupted and then must wait for another turn from the scheduler.

EXAM 2 STUDY QUESTIONS

- Section 3.2 – page 134
  1
  2

- Section 3.3 – page 137
  1