Sample Exam Questions

1. The velociraptor spots you 40 meters away and attacks, accelerating at 4 m/s² up to its top speed of 25 m/s. When it spots you, you begin to flee, quickly reaching your top speed of 6 m/s. How far can you get before you're caught and devoured?

2. You are at the center of a 20m equilateral triangle with a raptor at each corner. The top raptor has a wounded leg and is limited to a top speed of 10 m/s.

   (Not to scale)

   The raptors will run toward you. At what angle should you run to maximize the time you stay alive?

3. Raptors can open doors, but they are slowed by them. Using the floor plan on the next page, plot a route through the building, assuming raptors take 5 minutes to open the first door and halve the time for each subsequent door. Remember, raptors run at 10 m/s and they do not know fear.
1. The velociraptor spots you 40 meters away and attacks, accelerating at 4 m/s² up to its top speed of 25 m/s. When it spots you, you begin to flee, quickly reaching your top speed of 6 m/s. How far can you get before you’re caught and devoured?

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(Not to scale)

The raptors will run toward you. At what angle should you run to maximize the time you stay alive?

3. Raptors can open doors, but they are slowed by them. Using the floor plan on the next page, plot a route through the building, assumingly raptors take 5 minutes to open the first door and half the time for each subsequent door. Remember, raptors run at 10 m/s and they do not know fear.
EECS 370 Discussion

Topics Today:

– Processor Components

– Single-Cycle Datapath

– Project 2

– Time for Questions
LC2Kx Datapath Implementation
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Processor Components

Control Blocks
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Processor Components - Mux

- Used to choose options

```java
if (select == 0) {
    OUT = IN1;
} else {
    OUT = IN2;
}
```

![2 to 1 MUX diagram](image)
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Processor Components - Decoder

Allows an N-bit binary number to select one of $2^N$ output lines

<table>
<thead>
<tr>
<th>IN</th>
<th>OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>00000001</td>
</tr>
<tr>
<td>001</td>
<td>00000010</td>
</tr>
<tr>
<td>010</td>
<td>00000100</td>
</tr>
<tr>
<td>011</td>
<td>00001000</td>
</tr>
<tr>
<td>100</td>
<td>00010000</td>
</tr>
<tr>
<td>101</td>
<td>00100000</td>
</tr>
<tr>
<td>110</td>
<td>01000000</td>
</tr>
<tr>
<td>111</td>
<td>10000000</td>
</tr>
</tbody>
</table>
# EECS 370 Discussion

## Processor Components – ROM

Just a memory!

<table>
<thead>
<tr>
<th>Address</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>1001</td>
</tr>
<tr>
<td>001</td>
<td>0100</td>
</tr>
<tr>
<td>010</td>
<td>0010</td>
</tr>
<tr>
<td>011</td>
<td>1001</td>
</tr>
<tr>
<td>100</td>
<td>0010</td>
</tr>
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<td>101</td>
<td>0001</td>
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<tr>
<td>110</td>
<td>1000</td>
</tr>
<tr>
<td>111</td>
<td>0000</td>
</tr>
</tbody>
</table>
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Processor Components – ROM
EECS 370 Discussion

Processor Components – ROM
EECS 370 Discussion

Processor Components

Mathematic Blocks
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Processor Components – Sign Extension Unit

Increases the number of bits in a value
Adds 1s or 0s as appropriate
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Processor Components – Adder

OUT = IN1 + IN2;

Is this a Half-Adder or Full-Adder?
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Processor Components – ALU

Performs math operations

```java
if (f == 0) {
    OUT = IN1 + IN2;
} else {
    OUT = IN1 ~& IN2;
}

EQ = (IN1 == IN2);
```
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Processor Components

State Blocks
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Processor Components – Registers

![Register File or Register Diagram](image)
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Processor Components – Memory
EECS 370 Discussion

Single Cycle Datapath
LC2Kx Datapath Implementation
EECS 370 Discussion

Single Cycle Datapath

Key Concept: Entire path executes in a single clock cycle

  Fetch Instruction
  Decode Instruction
  Execute Instruction
  Memory Access
  Writeback Data

This limits the clock speed to slowest instruction
## EECS 370 Discussion

### Single Cycle Datapath

<table>
<thead>
<tr>
<th>Inst</th>
<th>I-Mem Access</th>
<th>Read Register</th>
<th>ALU Operation</th>
<th>D-Mem Access</th>
<th>Write Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>add</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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</tr>
<tr>
<td>nand</td>
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<td></td>
</tr>
</tbody>
</table>

**Example:** 5ns Reg Access, 10ns ALU Op, 20ns Mem Access
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Project 2
**Suggested Register Convention**

*HIGHLY* recommended you follow this

<table>
<thead>
<tr>
<th>Register</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>R0</td>
<td>Value 0</td>
</tr>
<tr>
<td>R1</td>
<td>Input N</td>
</tr>
<tr>
<td>R2</td>
<td>Input R</td>
</tr>
<tr>
<td>R3</td>
<td>Return Value</td>
</tr>
<tr>
<td>R4</td>
<td>Local Variable</td>
</tr>
<tr>
<td>R5</td>
<td>Stack Pointer</td>
</tr>
<tr>
<td>R6</td>
<td>Temporary Value</td>
</tr>
<tr>
<td>R7</td>
<td>Return Address</td>
</tr>
</tbody>
</table>
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Exam Review Questions

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