Final Exam Review Suggestions (Part 1)

As you prepare for the Final Exam, I recommend that you review your lecture notes (and the related examples), the readings in the textbook, and the self-study exercises.

The first segment of the course focused on the following topics:

- Course introduction (Harris, 1.1-1.6)
- Combinational circuits (Harris, 2.1-2.9)
- Sequential circuits (Harris, 3.1-3.5)
- Integer arithmetic (Harris, 5.1-5.2)
- Floating point arithmetic (Harris, 5.3)

The following self-study exercises were available:

- Lab Exercise #1 -- Combinational Circuits
- Lab Exercise #2 -- Combinational Components
- Lab Exercise #3 -- Sequential Circuits
- Lab Exercise #4 -- Integer Operations
- Lab Exercise #5 -- Number Systems and Internal Representation

Note that the first three self-study exercises had quite a bit of material on how to use "sim" and that material is not relevant for the Final Exam.

Prior to Exam #1, I posted study suggestions:

http://www.cse.msu.edu/~cse320/General/exam1.sample.pdf

It might be useful to review that file, as well as your exam booklet and answers from Exam #1.

On the next four pages are 12 sample questions (the answer key is below).

01. D  
02. C  
03. A  
04. B  
05. B  
06. D  
07. B  
08. E  
09. E  
10. B  
11. D  
12. C
01. What combinational component does the following truth table represent?

<table>
<thead>
<tr>
<th>A B C</th>
<th>D E F G</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>0 0 1</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>0 1 0</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>0 1 1</td>
<td>0 0 0 0</td>
</tr>
<tr>
<td>1 0 0</td>
<td>1 0 0 0</td>
</tr>
<tr>
<td>1 0 1</td>
<td>0 1 0 0</td>
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<tr>
<td>1 1 0</td>
<td>0 0 1 0</td>
</tr>
<tr>
<td>1 1 1</td>
<td>0 0 0 1</td>
</tr>
</tbody>
</table>

A) A decoder, where signals A and B are the control signals  
B) An encoder, where signals A and B are the control signals  
C) A multiplexer, where signal A is the data signal  
D) A demultiplexer, where signal A is the data signal  
E) None of the above.

02. What combinational component does the following truth table represent?

<table>
<thead>
<tr>
<th>A B C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0</td>
<td>0</td>
</tr>
<tr>
<td>0 0 1</td>
<td>0</td>
</tr>
<tr>
<td>0 1 0</td>
<td>1</td>
</tr>
<tr>
<td>0 1 1</td>
<td>1</td>
</tr>
<tr>
<td>1 0 0</td>
<td>0</td>
</tr>
<tr>
<td>1 0 1</td>
<td>1</td>
</tr>
<tr>
<td>1 1 0</td>
<td>0</td>
</tr>
<tr>
<td>1 1 1</td>
<td>1</td>
</tr>
</tbody>
</table>

A) a decoder, where signal A is the enable signal  
B) an encoder, where signal A is the enable signal  
C) a multiplexer, where signal A is the control signal  
D) a demultiplexer, where signal A is the control signal  
E) None of the above.

03. What combinational component does the following characteristic table represent?

<table>
<thead>
<tr>
<th>A B C D</th>
<th>E F G</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 0 0 0</td>
<td>X X 0</td>
</tr>
<tr>
<td>0 0 0 1</td>
<td>0 0 1</td>
</tr>
<tr>
<td>0 0 1 X</td>
<td>0 1 1</td>
</tr>
<tr>
<td>0 1 X X</td>
<td>1 0 1</td>
</tr>
<tr>
<td>1 X X X</td>
<td>1 1 1</td>
</tr>
</tbody>
</table>

A) A priority encoder, where signal A has priority  
B) A multiplexer, where signal A is the control signal  
C) A demultiplexer, where signal A is the control signal  
D) A decoder, where signal A is the enable signal  
E) None of the above.
Consider the following timing diagram for a particular circuit. Assume that "CLOCK" and "DATA" represent the only two inputs to the circuit, and that "OUT" represents the only output signal.

What is the best characterization of this circuit?

A) Level-triggered sequential circuit
B) Negative edge-triggered sequential circuit
C) Positive edge-triggered sequential circuit
D) None of the above.

What is the optimal expression for the following Boolean function (given as a minterm list)?

\[ f(w,x,y,z) = m_1 + m_4 + m_5 + m_9 + m_{12} + m_{13} + m_{14} \]

A) \( xy'z' + y'z + wxyz' \)
B) \( xy' + y'z + wxz' \)
C) \( xy'z' + x'y'z + wz' \)
D) \( xy' + w'x'y'z + wx'y'z + wxyz' \)
E) None of the above.
A circuit functions as a specialized three-bit counter, where the sequence of outputs from the circuit are: 001, 100, 111, 001, 100, 111, and so on.

The mapping of the current state to the next state uses the notation ABC, where A represents the most significant bit of the counter and C represents the least significant bit of the counter.

06. Consider the circuit described in Figure 1. Which of the following is the optimal expression for A?

A) \( A = AB' + A'C \)
B) \( A = AB'C' + A'B'C \)
C) \( A = B'C' + A'C \)
D) \( A = B' \)
E) None of the above.

07. Consider the circuit described in Figure 1. Which of the following is the optimal expression for B?

A) \( B = AB' \)
B) \( B = C' \)
C) \( B = AB'C' \)
D) \( B = B'C' \)
E) None of the above.

08. Consider the circuit described in Figure 1. Which of the following is the optimal expression for C?

A) \( C = B + C' \)
B) \( C = BC + B'C' \)
C) \( C = B + B'C' \)
D) \( C = AB'C' + ABC \)
E) None of the above.
09. Consider the 32-bit single precision floating point number whose internal representation is 00FFFFFF (in hexadecimal). Which of the following statements about that number is correct?

A) The bit pattern represents zero.
B) The bit pattern represents a denormal number.
C) The bit pattern represents infinity.
D) The bit pattern represents not-a-number.
E) None of the above.

10. What is the 32-bit single precision internal representation (in hexadecimal) of the decimal value given below?

+0.625 (base 10)

A) 7e400000 (base 16)
B) 3f200000 (base 16)
C) 7fa00000 (base 16)
D) None of the above.
E) 3fd00000 (base 16)

11. Consider the 64-bit double precision floating point number whose internal representation is FFFFFFFFFFFFFFFF (in hexadecimal). Which of the following statements about that number is correct?

A) The bit pattern represents zero.
B) The bit pattern represents a denormal number.
C) The bit pattern represents infinity.
D) The bit pattern represents not-a-number.
E) None of the above.

12. What is the 64-bit double precision internal representation (in hexadecimal) of the decimal value given below?

-24.5 (base 10)

A) c04c400000000000 (base 16)
B) bfb880000000000 (base 16)
C) c03880000000000 (base 16)
D) bfac400000000000 (base 16)
E) None of the above.