**Ahsanullah University of Science and Technology**

**CSE 3109 Digital System Design Quiz 2 09-07-17 Marks 20**

1. Show all the steps of Booths algorithm for the following 6 bit numbers: **8**

X= 10 Y = -16

1. Design a hard-wired control to implement the addition and subtraction of two fixed-point binary numbers represented in sign magnitude form. Your design must include the following steps:
2. Derivation of the Algorithm
3. Flowchart
4. Control state diagram and
5. Sequence of microoperations

You must use an ALU that has the following function table: **12**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S2 | S1 | S0 | Cin | Output |
| 0 | 0 | 1 | 0 | F = A + B |
| 0 | 1 | 0 | 1 | F = A – B |
| 1 | 1 | 1 | 0 | F = A’ |
| 0 | 0 | 0 | 1 | F = A + 1 |

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1. Show all the steps of Booths algorithm for the following 6 bit numbers: **8**

X= 12 Y = -12

1. The symbolic microprogram for control memory is given below: **12**

|  |  |  |
| --- | --- | --- |
| ROM  address | Microinstruction | Comments |
| 0 | x = 1,if (qs = 1) then ( go to 1), if (qa = 1) then ( go to 2), if ( qs ^ qa = 0) then ( go to 0) | Load 0 or external addres |
| 1 | Bs ⃪ Bs’ | qs = 1, start subtraction |
| 2 | If ( S = 1) then ( go to 4) | qa = 1, start addition |
| 3 | A ⃪ A + B, E ⃪ Cout , go to 0 | Add magnitudes and return |
| 4 | A ⃪ A + B’ + 1, E ⃪ Cout | Subtract magnitudes |
| 5 | If ( E = 1) then ( go to 0), E ⃪ 0 | Operation terminated if E = 1 |
| 6 | A ⃪ A’ | E = 0, complement A |
| 7 | A ⃪ A + 1, As ⃪ As’, go to 0 | Done, return to address 0 |

Here L variable loads A and E from ALU, y variable complements Bs , z variable complements As and w variable clears E. And the ALU has the following function table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S2 | S1 | S0 | Cin | Output |
| 0 | 0 | 1 | 0 | F = A + B |
| 0 | 1 | 0 | 1 | F = A - B |
| 1 | 1 | 1 | 0 | F = A’ |
| 0 | 0 | 0 | 1 | F = A + 1 |

Write the binary microprogram for the control memory and also draw microprogram control block diagram.

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1. Show all the steps of Booths algorithm for the following 6 bit numbers: **8**

X= 5 Y = -12

|  |  |
| --- | --- |
| **Figure 1:** control state diagram for question no. 2  z = 0    x = 0 x = 1 y = 1    y = 0      z = 1 |  |
| The state diagram of a control unit is shown in Figure 1. It has eight states and three inputs x, y and z. |  |
| 1. Design the control using eight D flip-flops. | **3** |
| 1. Design the control using three J-K flip-flops and a 3×8 decoder. | **5** |



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1. Show all the steps of Booths algorithm for the following 6 bit numbers: **8**

X= 5 Y = -12

1. The register configuration and flow chart of a digital system that multiplies two unsigned binary numbers by repeated addition method is shown in fig 1.
2. Let A = 0100 and B = 0011. Going through the steps in the flowchart, show that the system returns to the initial state, with register P having the product 1100. **5**
3. Draw a state diagram for the control and list the register transfers to be executed in each control state. **7**

**Figure 1 :** Multiplication by successive addition.

P 0 00

A

Control

Logic

**B**

**P**

P P+B

A A-1

Initial state

x = 1

**A**

qm =1 Multiplicand Multiplier

qm

Product x

= 0

≠ 0

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1. Show all the steps of Booths algorithm for the following 6 bit numbers: **8**

X= 10 Y = -16

|  |
| --- |
| **Figure 1:** control state diagram for problem **2**  x = 0  x = 1  x = 0 x = 0  y = 1 y = 0  x = 1, y = 0  x = 1 x = 1  y = 1 y = 0  x = 1, y = 1 |
| The state diagram of a control unit is shown in **Figure 1**. It has four states and two inputs x and y.   1. Design the control using four D flip-flops. **4** 2. Design the control using two J-K flip-flops and a 2×4 decoder. **8** |
|  |