Homework 4
EET 340
Introduction to Computer Organization and Architecture

INSTRUCTIONS: The homework solution can either be typed in word or handwritten. However, convert the word or scanned (handwritten) document to PDF and submit to blackboard.

1. (25 Points) Trace the data path taken by each instruction using Datapath source diagram. Mark the values of the control signals. Use a separate Datapath figure for each instruction shown below.

a. ADD X0, X2, X3
b. LDUR X2, [X3, #8]

2. (15 Points) What is instruction pipelining? Draw the multicycle pipelined diagram for the following code:

```
ADD X3, X0, X1
SUB X6, X4, X5
LSL X7, X0, #2
STUR X9, [X10, #0]
ADDI X12, X12, #1
```

3.

a. Identify Data hazards and number of stalls in the assembly code. Assume there is **no forwarding**. Rewrite the assembly code and show stalls in the code if any. (10 Points)
b. Reorder the above code **with forwarding** to reduce the stalls without changing the functionality. (15 Points)
c. Draw the multi-cycle pipeline diagram (one loop) for the optimized assembly code from section b. (15 Points)

```
SUBI X2, X2, #1
LSL X4, X2, #1
SUB X5, X9, X6
LDUR X7, [X0, #0]
ADDI X7, X7, #1
```

4. (20 Points) Do the following conversions:

(a) 3GB = in bits?
(b) 8388608 bits = in KB?
(c) 128 MB = in Byte?