CPE2323: Computer Architecture and Organization

Assignment # 2

Due Date: 18th Nov 2026 11:00 AM

1. RISC-V Register File & Stack Allocation:

Describe the role of the stack pointer register (sp, x2) in RISC-V architecture. If the initial stack pointer value is sp = 0x7FFFFFF0, calculate the new stack pointer address after allocating space for 4 local word variables (16 bytes).

2. Data Transfer & Effective Address Calculation:

Given the base address stored in register t0 = 0x10000000, write the RISC-V instruction lw x10, 12(t0) and compute the exact 32-bit effective memory address accessed. State which memory byte addresses are retrieved.

3. Bitwise Logical and Shift Operations:

Write a sequence of RISC-V instructions using registers x5, x6, and x7 to evaluate the bitwise operation:

$$x7 = (x5 \;\&\; 0x0F) \mid (x6 \ll 2)$$

Evaluate the final hexadecimal value stored in x7 given initial values $x5 = 0xAB$ and $x6 = 0x03$.

4. RISC-V Control Flow Encoding:

Write a RISC-V conditional branch sequence for the following C code using the appropriate branch instruction. Explain how the branch offset is calculated and encoded within a B-type instruction format.

```
If(x10==x11)
        x10++;
else
        x10--;
```

5. RISC-V R-Type Machine Coding:

Convert the RISC-V instruction add x10, x11, x12 into its 32-bit hexadecimal machine code representation. Show the bit breakdown and values for opcode, funct3, funct7, rs1, rs2, and rd.