**Problem 12.14.5**

(a) **What are the values of the ALU control unit's inputs for this instruction?**
sw $\boxed{ALUOp = 00}$, $\boxed{ALU control input = 0010}$

(b) **What is the new PC address after this instruction is executed? Highlight the path through which this value is determined.**
for sw $t4, 20($t5): the path begins at PC, then passes through the adder PC + 4, then to the branch mux, then goes back to PC. New PC address ends up being $\boxed{PC + 4}$

(c) **For each mux, show the values of its inputs and outputs during the execution of this instruction. List values that are register outputs at Reg [xn]**
0xadac0016 = 101011 01101 01100 0000000000010110
op = 101011 = 43
rs = 01101 = 13
rt = 01100 = 12
address = 0000 0000 0001 0110 = 22

| | alusrc | memtoreg | branch |
|---|---|---|---|
| INPUT | Reg[x12] and 22 | Inputs: Reg[x13] + 22 and <undefined> | PC + 4 |
| OUTPUT | Output: 22 | <undefined> | PC + 4 |

(d) **What are the input values for the ALU and the two add units?**
$\boxed{\text{alu}}$ Reg[x13] and 22
$\boxed{\text{PC + 4 adder}}$ PC and 4
$\boxed{\text{branch}}$ PC + 4 and 22 × 4

(e) **What are the values of all inputs for the registers unit?**