EE 3755, Spring 2003

HW # 6

Not to be returned; (it will not be graded)

EE 3755, [redacted] (1)

Homework # [redacted] 6

(1). Consider the microprogrammable "First Example Computer" presented in class (also see handouts) with microinstructions the ones shown by Figure 2 on page 7 of the handout entitled "Microprogram-Based Controllers" and microsequencer the one on page 15 of the handout entitled "Microprogram-Based Controllers".

Show in logic block diagram form the circuitry involved in implementing the following step of the computer's ATHPL control sequence.

33 MD ← 8T9, PC.

(2). Consider the microprogrammable "First Example Computer" presented in class (see handouts) and consider its branch micro-instruction shown on page 7 of handout entitled "Microprogram-based controllers" (see fig. 2(b)). Show the hardware implementation of the function "g" where "g" is a function that is true whenever the conditions for branching are met. You must consider the list of branch functions offered on

page 13 of the handout entitled: "Microprogram-Based controllers".

[3] Write a microprogram to implement steps 74, 75, 76, 77, 78, 79 of the "first example computer's" AHPL control sequence. Express your microprogram in HICRAL. ROM addresses should be given in hex form. Start your microprogram at ROM address 2000 hex. Assume the microinstructions being the ones shown on page 7 of the handout entitled "Microprogram-based controllers" and list of bus connections, targets, etc., branch functions the ones shown on pages 8, 9, ... 13 of the same handout. Microcode in binary only step 77.

[4]. Consider the "Second example computer" described in the handout entitled: "Second example computer". The block diagram of the computer is shown on page 1 of the corresponding handout. Write in AHPL the steps

for the execution of the following instructions.

(a) Jump register (see page 6 of handout for explanations).

(b) Register transfer instruction (see page 11 of handout etc)

(c) Format B ADD instruction (see pages 12-13 of handout etc)

(d) Format B load instruction (see page 10 of handout etc).

(e) Load lower immediate instruction (see page 13 of handout).

5 Consider the "Second example computer" (described in the respective handout) and consider its Format A logic instructions explained on pages 4 and 5 of the handout.

→ Go to next page.

Using a sequence of only three such logic instructions show how you can exchange (swap) the contents of registers R5 and R7 without affecting the contents of any other register in the computer. No other instructions are allowed.

→ Hint: What is the value of A XOR B XOR A?
Here XOR stands for exclusive OR.

** Use simple notations to express each of your three logical instructions. For example, the instruction i below

Instruction i : R12 ← R10 ∧ R15

means store in reg R12 the result of logically ANDING the contents of registers R10 and R15 etc...