

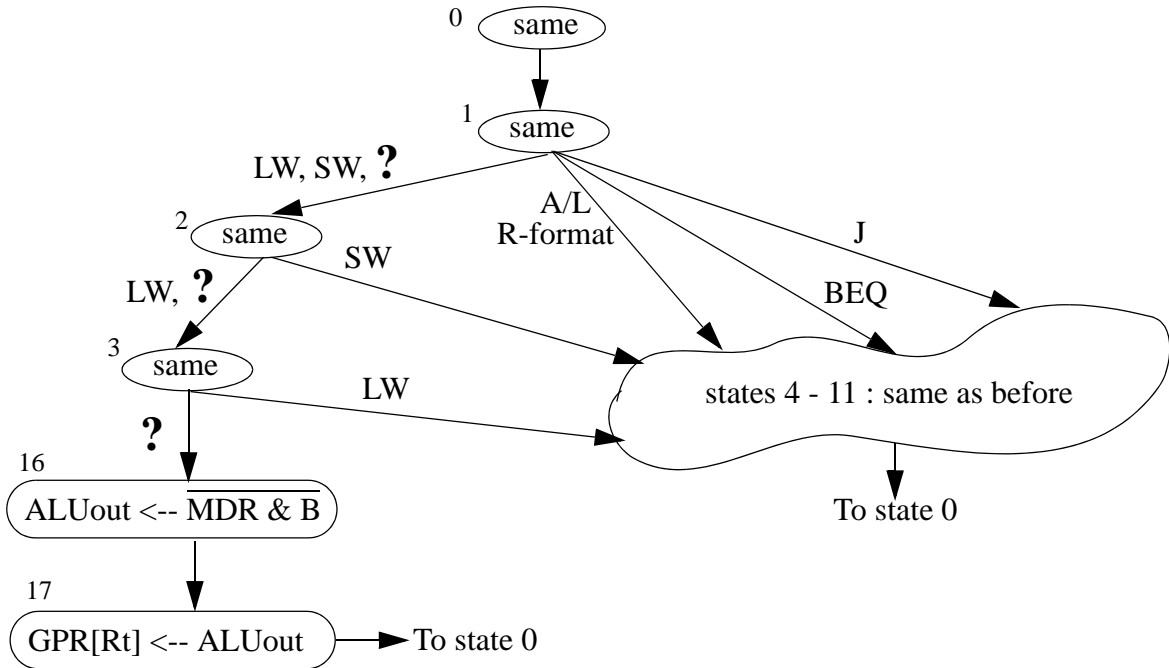


EXAM II
110 MINUTES
WORK ALL PROBLEMS

OPEN BOOK

(40 pts)

1) Assume that the EMY CPU **high-level** state diagram is modified to be able to run a **new** instruction as follows :



a) What is the **new** instruction ? Indicate **only** the following :

- Syntax
- Semantics
- Format
- Memory accesses made

b) Modify the EMY CPU **datapath** accordingly.

What is CPI₇ ? **Explain.**

c) Modify the EMY CPU **low-level** state diagram accordingly and as done in class.

(60 pts)

2) Consider the following instruction that does **not** exist in the EMY instruction set :

INCMAI Disp(Rs)++

The semantics of the instruction is as follows :

$$\begin{array}{l} M[\text{Disp}^+ + \text{Rs}] \longleftarrow M[\text{Disp}^+ + \text{Rs}] + 1 \\ \text{then} \\ \text{Rs} \longleftarrow \text{Rs} + 4 \end{array}$$

The **Increment Memory Auto Increment** (INCMAI) instruction increments a memory location and then automatically increments the pointer register.

a) Modify the EMY CPU **high-level** state diagram, as done in class.

If a state is the same as the original, just write “Same.”

What is $\text{CPI}_{\text{INCMAI}}$? **Explain.**

b) Modify the EMY CPU **datapath** accordingly and as done in class.

c) Modify the EMY CPU **low-level** state diagram accordingly and as done in class.