COA IAT3 Scheme and Solution Feb 2022

1. Explain single bus organization of datapath in a processor with a neat diagram. (10)

Diagram-5 M

Explanation on each block-5 M

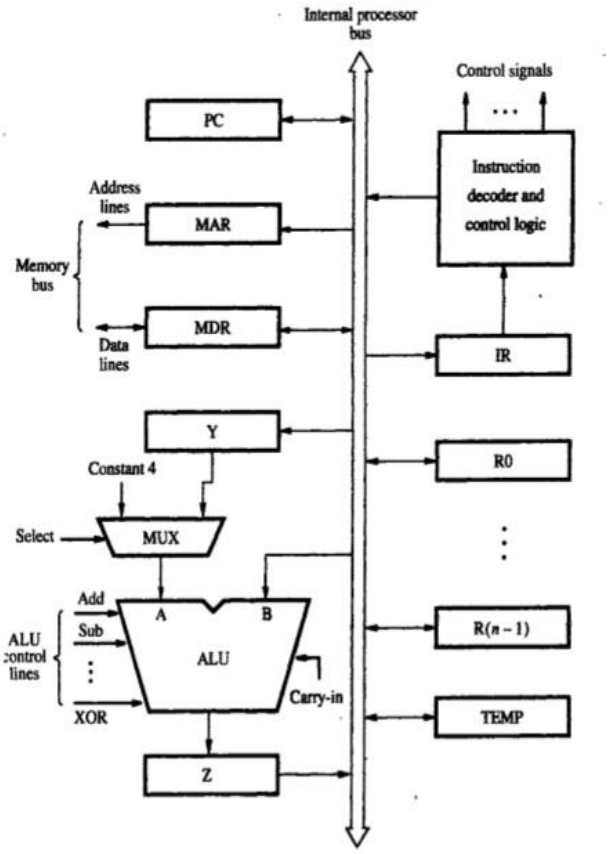

Figure 7.1 Single-bus organization of the datapath inside a processor.

2. Describe the sequence of control signals to be generated to fetch an instruction from memory in a single bus organization.

Sequence-5 M

Explanation-5 M

Step	Action
1	PC_{out}, MAR_{in}, Read, Select4, Add, Z_{in}
2	Z_{out}, PC_{in}, Y_{in}, WMFC
3	MDR_{out}, IR_{in}
4	$R3_{out}$, MAR_{in}, Read
5	$R1_{out}$, Y_{in}, WMFC
6	MDR_{out}, SelectY, Add, Z_{in}
7	Z_{out}, $R1_{in}$, End

Figure 7.6 Control sequence for execution of the instruction Add (R3),R1.

3. Explain the organization of a complete processor, with the help of a block Diagram.

Diagram-5 M

Explanation-5 M

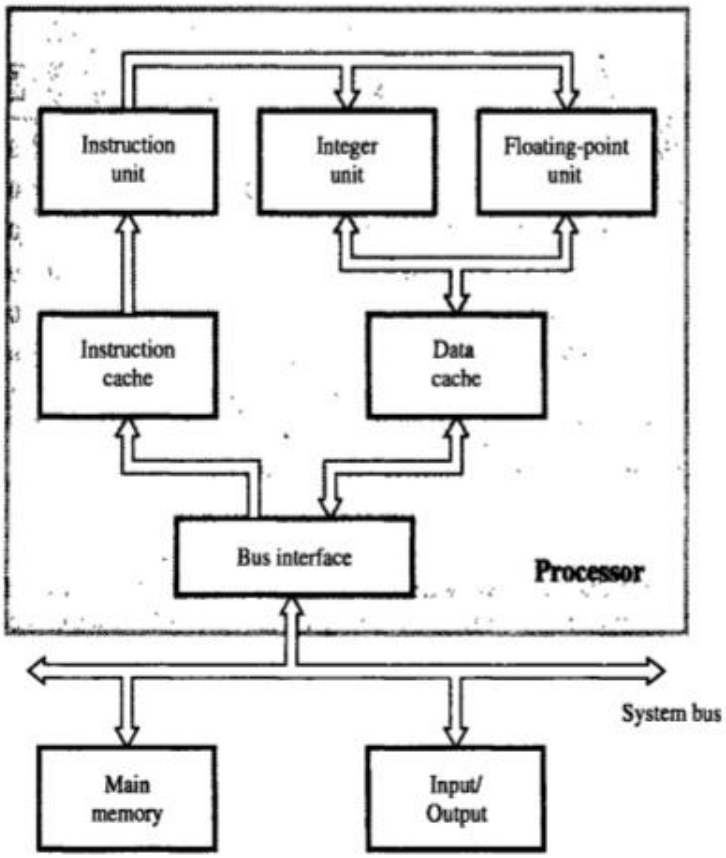

Figure 7.14 Block diagram of a complete processor.

4. With a neat diagram, discuss three bus organization of CPU. Compare the performance with single-bus organization.

Diagram-5 M

Explanation-5 M

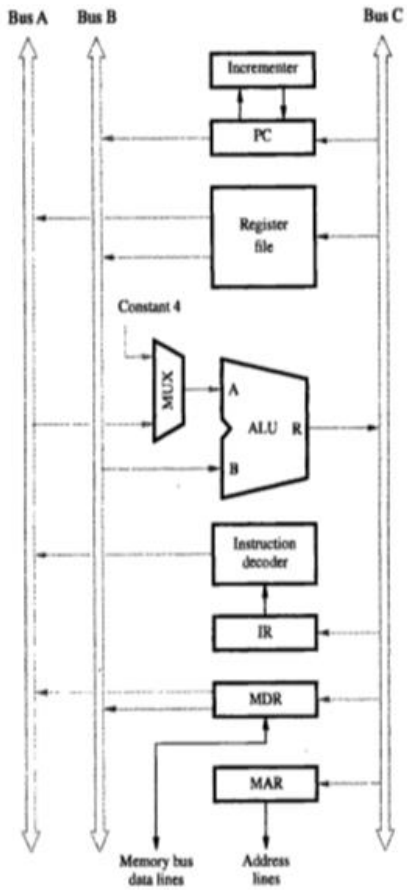

Figure 7.8 Three-bus organization of the datapath.

5. Discuss Hardwired control unit organization with relevant diagrams and illustrate the logic to generate Z in control signal.

Diagrams- 5 M

Explanation- 5 M

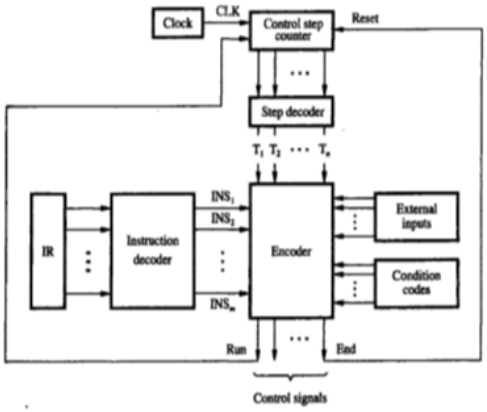

Figure 7.11 Separation of the decoding and encoding functions.

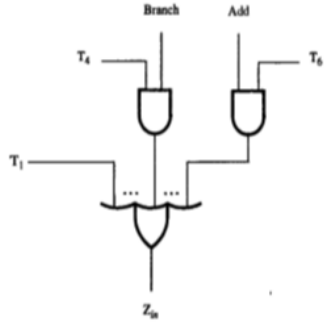

Figure 7.12 Generation of the Z_{in} control signal for the processor in Figure 7.1.

6. Write a microroutine for any conditional branching instruction(with suitable comments) w.r.t Microprogrammed control.

Microroutine-5 M

Explanation-5 M

Address	Microinstruction
0	PC_{out}, MAR_{in}, Read, Select4, Add, Z_{in}
1	Z_{out}, PC_{in}, Y_{in}, WMFC
2	MDR_{out}, IR_{in}
3	Branch to starting address of appropriate microroutine
...	...
25	If N=0, then branch to microinstruction 0
26	Offset-field-of-IR_{out}, SelectY, Add, Z_{in}
27	Z_{out}, PC_{in}, End

Figure 7.17 Microroutine for the instruction Branch < 0.

7. With a block diagram, describe the organization of a microprogrammed control unit.

Diagram-5 M

Explanation-5 M

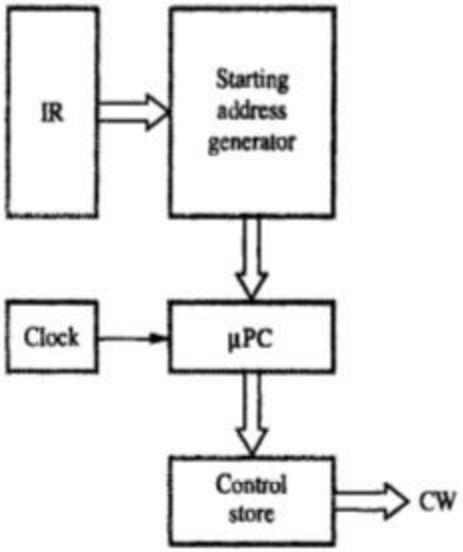

Figure 7.16 Basic organization of a microprogrammed control unit.