Assignment-4

Dt- 24/04/24

① Explain the difference between hardwired control and microprogrammed control with its circuit model. Is it possible to have a hardwired control associated with a control memory?

A- The main difference between hardwired and microprogrammed control lies in their implementation approach and flexibility.

•) Hardwired control uses fixed logic gates to directly generate control signals. It's fast but lacks in flexibility. Changing the control logic requires modifying the hardware.

•) Microprogrammed control uses a control memory to store microinstructions. It is more flexible as control logic changes can be achieved by modifying the microinstructions stored in the control memory.

Circuit model of Hardwired control-:

In a hardwired control system, the control unit consists of a network of logic gates interconnected to interpret the instruction opcode and generate the necessary control signals.

Circuit model of microprogrammed control-:

The control unit in a microprogrammed system comprises a control memory holds micro-instructions register and a sequencer.

(ii) Technically, it is possible to combine elements of hardwired control with a control memory. This approach can offer a balance between speed and flexibility, leveraging the strengths of both hardwared and microprogrammed control.

Q 2 Show how a 9-bit micro-operation field in a microinstruction can be divided into subfields to specify 46 microoperations. How many microoperation can be specified in one microinstructor.

A- To specify 46 microoperations using a 9-bit microoperation field in a microinstruction, we can divide the 9 bits into subfields of varying lengths to represent different aspects of the microoperations.

-> Opcode field : 6 bits

This leaves us with 3 remaining bits from the 9-bit microoperation field. These bits can be used for modifiers or additional information if needed.

So each microinstruction specifies one microoperation and with 6 bits allocated for the opcode field, we can uniquely represent $2^6 = 64$ different microoperations.

Therefore, in one microinstruction, we can specify upto 64 microoperations.

Q3 Why is the wait for memory function-completed step is needed while reading or storing a data to/from memory?

A- Here is why it is needed -:

(i) Memory Access Speed -:

Memory access is generally slower compared to the speed of the CPU.

(ii) Synchronization -: When the CPU initiates a memory read or write operation, it needs to wait for the memory subsystem to complete the operation before proceeding with the next instruction.

(iii) Avoiding Data Hazards -: Additionally, in modern pipelined CPUs, the wait-for-memory function-complete' step helps avoid data hazards. Without proper synchronization, these hazards can lead to incorrect program behaviour.

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Name - Soumya R. Sahoo
Reg - 2201020420
Group- 7
Branch- CSE (AI & ML)
Sem- 4th