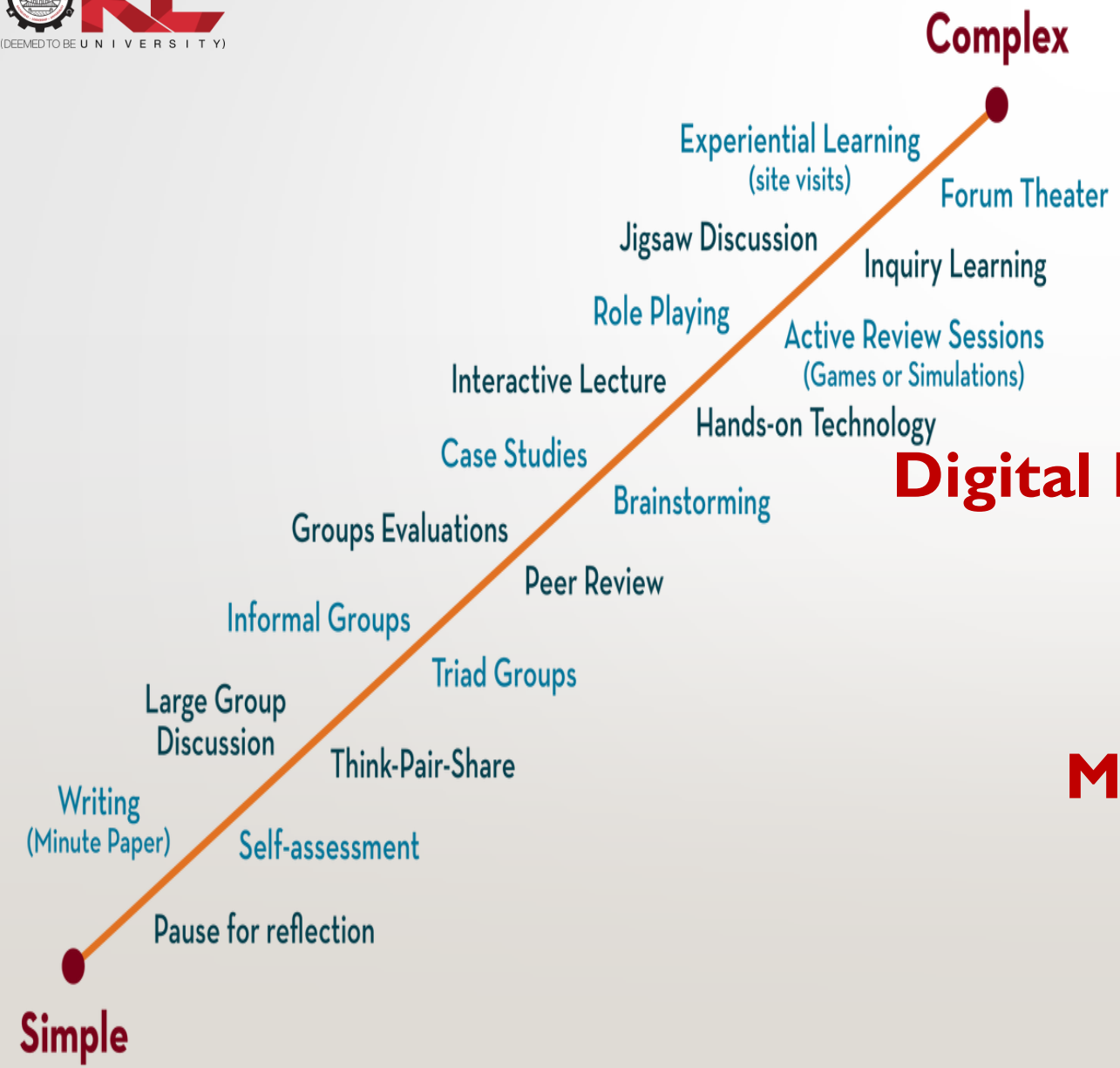


Department of BES-II

Digital Design and Computer Architecture

23EC1202

Topic:

Hardwired Realization Vs Micro-programmed realization, Multicycle Implementation

Session No: 27 & 28

AIM OF THE SESSION

To familiarize students with the basic concept of Hardware Realization Vs Micro Progrmmed Realization and Mutlicycle Implementation

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

1. Demonstrate the concepts of the computer architetcture and its basics concepts.
2. Describe the realization and its basics introduction.
3. List out the the different steps involue in the realization.
4. Describe the the concept of multicycle implementation.

LEARNING OUTCOMES

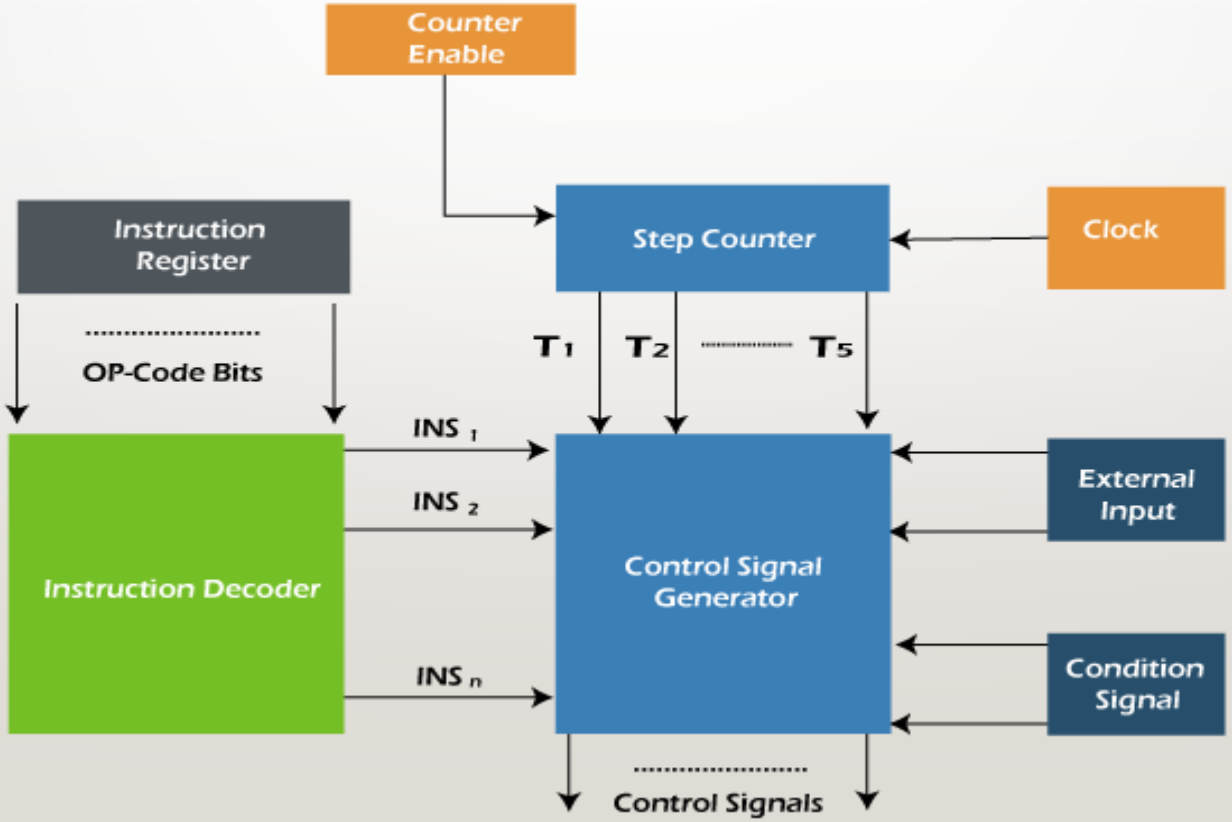
At the end of this session, you should be able to:

1. Define the realization and its importance.
2. Describe the Multicycle implementation.
3. Summarize the overall concepts of Hardware Realization Vs micro programmed realization and muticycle implementation.

Hardwired Realization Vs Micro-programmed realization

- Micro programmed control units and hardwired control units can be called two types of control units. We can execute an instruction with the help of these two control units.
- In the **hardwired control unit**, the execution of operations is much faster, but the implementation, modification, and decoding are difficult.
- In contrast, implementing, modifying, decoding **micro-programmed control units** is very easy. The micro-programmed control unit is also able to handle complex instructions.

Hardwired


Counter Enable
Instruction Register
Step Counter
Clock
OP-Code Bits
T1
T2
T5
INS 1
INS 2
INS n
Instruction Decoder
Control Signal Generator
External Input
Condition Signal
Control Signals

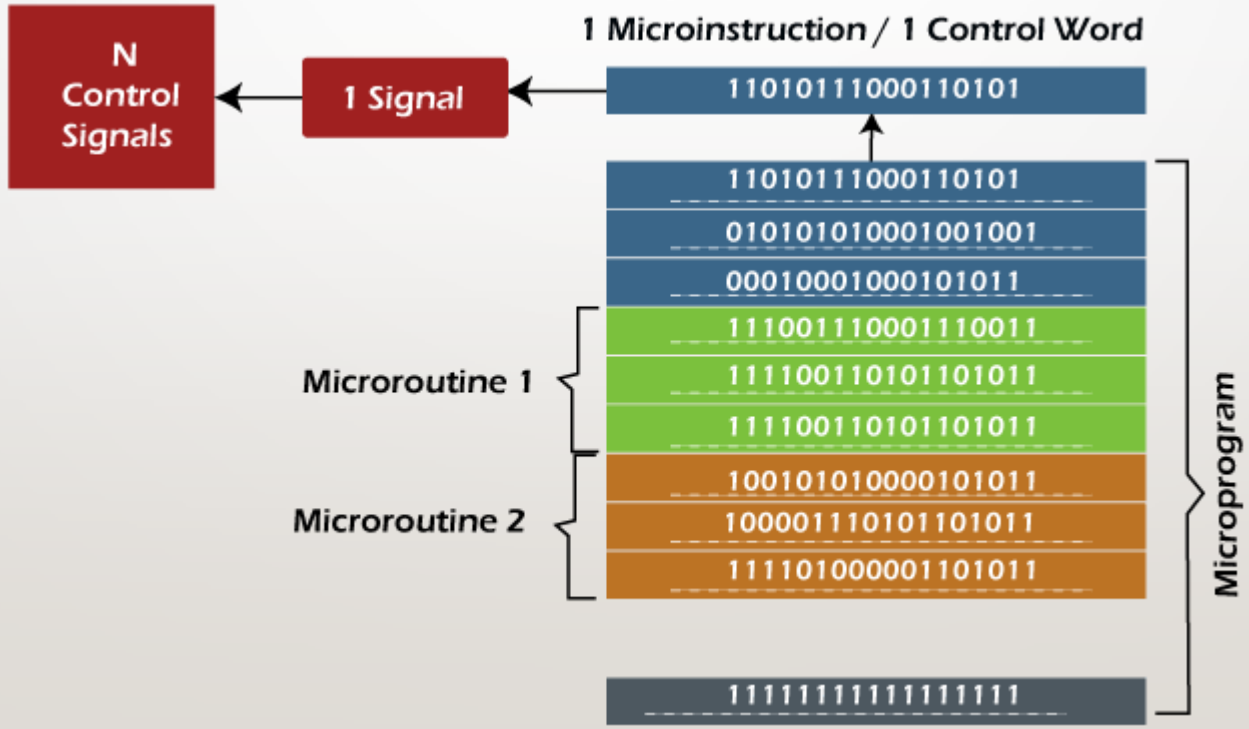
Micro-programmed Realization

- A micro-program is used to contain a set of microinstructions. Each microinstruction or control word contains different bit patterns.

- The n bit words are contained by each microinstruction. On the basis of the bit pattern of a control word, every control signals differ from each other.

- For each step, the micro-program contains a control word/ microinstruction. If we want to execute a particular instruction, we need a sequence of microinstructions. This process is known as the micro-routine.

Micro-programmed Realization



Hardwired Realization Vs Micro-programmed realization

Hardwired	Micro-programmed
With the help of a hardware circuit, we can implement the hardwired control unit.	While with the help of programming, we can implement the micro-programmed control unit.
The hardwired control unit uses the logic circuit so that it can generate the control signals, which are required for the processor.	The micro-programmed CU uses microinstruction so that it can generate the control signals. Usually, control memory is used to store these microinstructions.
In the form of logic gates, everything has to be realized in the hardwired control unit. That's why this CU is more costly as compared to the micro-programmed control unit.	The micro-programmed control unit is less costly as compared to the hardwired CU because this control unit only requires the microinstruction to generate the control signals.

Multicycle Implementation

- The basic idea of the multicycle implementation is to divide the one long cycle of the single cycle implementation into 3 to 5 shorter cycles. The number of cycles depends on the instruction.
- Unlike pipelining, where different instructions are executed in parallel stages, a multicycle approach executes different parts of a single instruction in each cycle.
- This approach aims to optimize the use of hardware by reusing the same set of resources for different stages of instruction execution, rather than dedicating separate hardware for each stage.

Key Characteristics of Multicycle Implementation

- Reuse of Hardware Components
- Variable Execution Time
- Control Logic Complexity
- Efficiency and Performance

SELF-ASSESSMENT QUESTIONS

1. What is the primary characteristic of a hardwired control unit?

(a) Indirect control signal generation

(b) Direct control signal generation through combinational logic

(c) Microinstruction sequencing

(d) Extensive use of control memory

2. Which of the following is a drawback of hardwired realization?….

(a) Limited flexibility

(b) B. Slower execution speed

(c) C. Requires additional memory

(d) D. Well-suited for evolving instruction sets

TERMINAL QUESTIONS

Short answer questions:

1. List the characteristics of a multicycle implementation in processor design.
2. Highlight the advantages of hardwired realization in the control unit design of a microprocessor.

Long answer questions:

1. Differentiate hardwired realization and micro-programmed realization in the design of control units within a CPU.
2. Illustrate the hardwired realization in CPU design, detailing its architecture.
3. Illustrate the micro-programmed realization in CPU design, detailing its architecture.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer Organization by Carl Hamacher, Zvonko Vranesic and Saftwat Zaky.
2. Computer System Architecture by M. Morris Mano
3. Computer Organization and Architecture by William Stallings

Sites and Web links:

1. https://www.eecg.toronto.edu/~moshovos/ECE243-07/l20-multicycle.html
2. https://www.doc.ic.ac.uk/~wl/teachlocal/arch/HP05/multi-cycle-datapath.pdf

THANK YOU

(DEEMED TO BE UNIVERSITY)

Team – Digital Design & Computer Architecture