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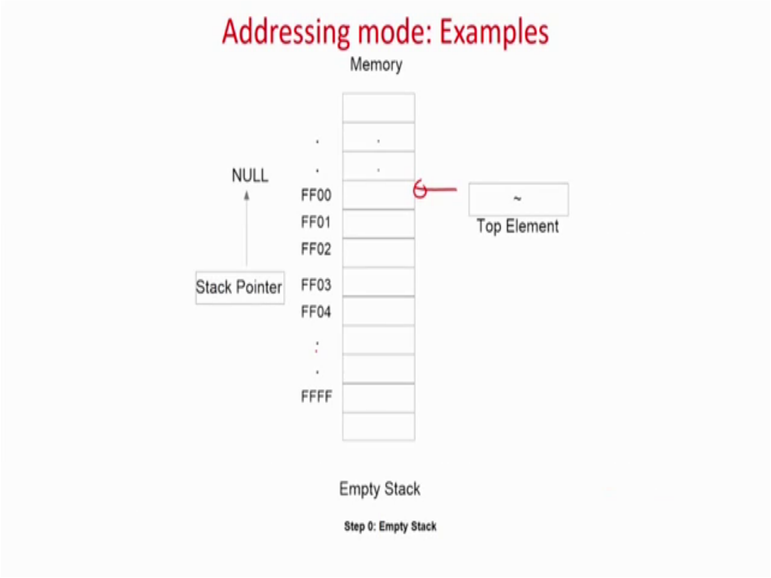

So, this is an empty stack and then this is the stack pointer maybe say that we will start pointing from here this is the top element, this is the whole stack available. And we will do some of the instruction which we have seen in the this question that we will first push 15; then push 12; then 15 then we will add and so on. So, this is the first scenario.

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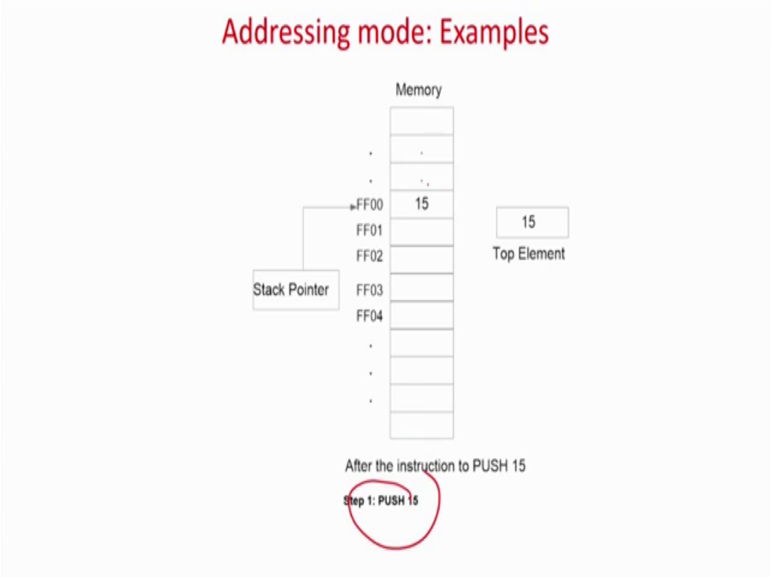

Then we say that push 15; so 15 will be pushed in the top position because it’s an infinite stack because this may be available to program one.

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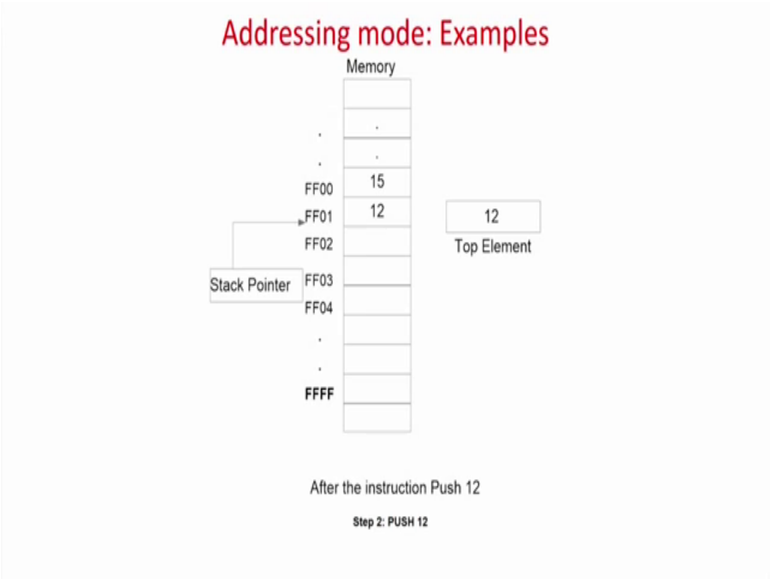

After the instruction Push 12

Step 2: PUSH 12

Then the other part maybe available to some other program and so forth. Then it is saying push 12. So, again 12 will be pushed then we again say push 15, so the value of 15 has come next you see I will say add.

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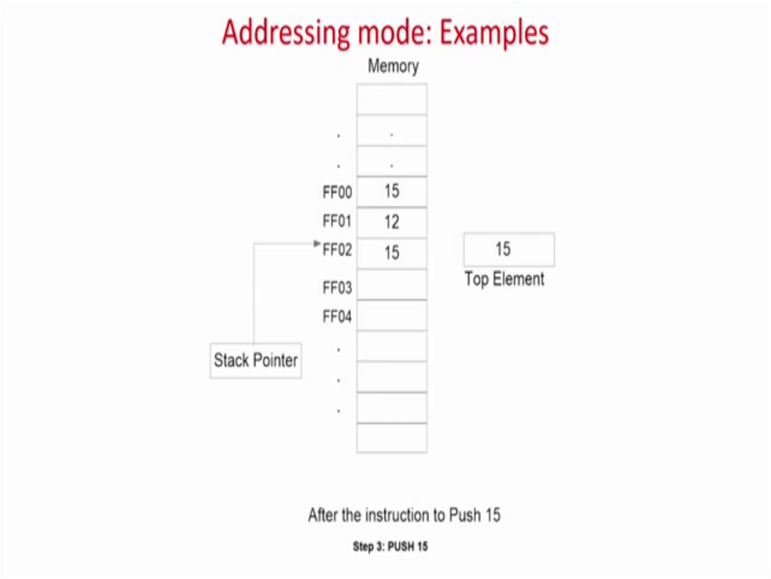

After the instruction to Push 15

Step 3: PUSH 15

So, what if you say add what happens? If you take the top 2 elements add it and put the value there itself.

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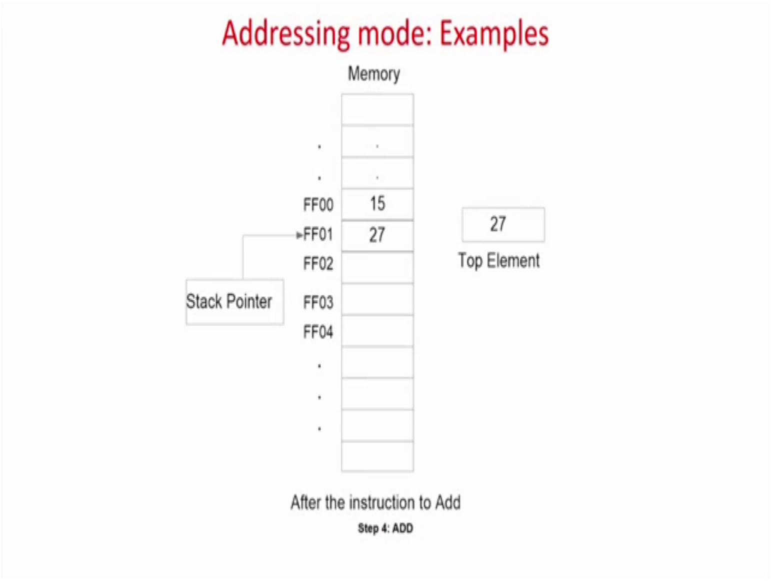

Addressing mode: Examples

After the instruction to Add

Step 4: ADD

So, it is 15 + 12 is 27. So, 27 is pushed back over there and this is the stack pointer.

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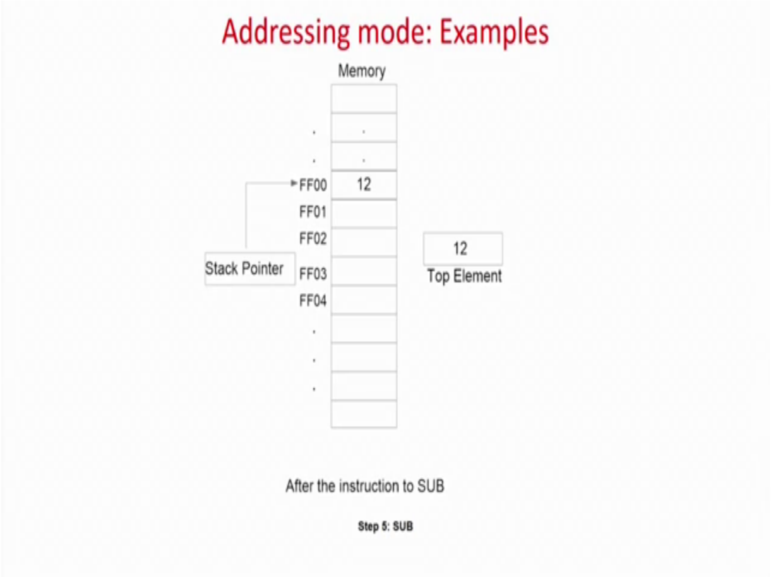

Addressing mode: Examples

After the instruction to SUB

Step 5: SUB

Then I say sub then what will happen it will subtract these 2 values. So, it is 15, 27 - 15 that is equal to 12 so this subtraction will be that the value of 12 will be present over here.

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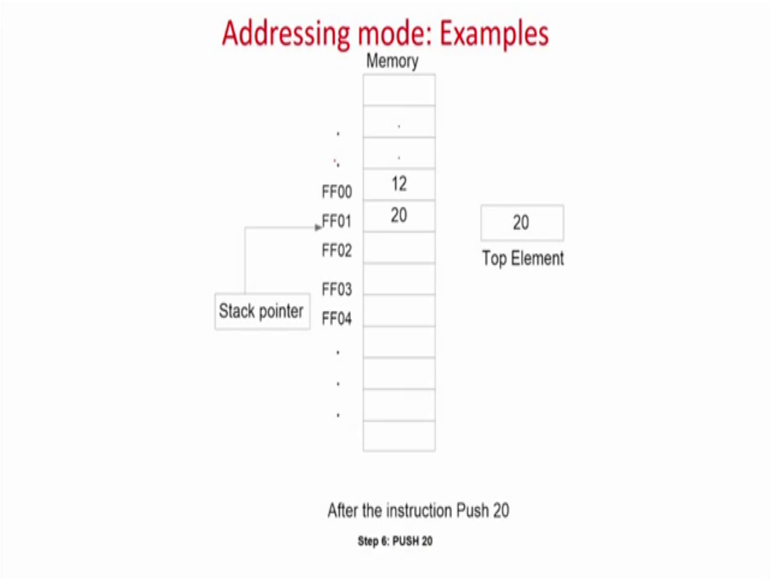

Addressing mode: Examples

After the instruction Push 20

Step 6: PUSH 20

Then I say again say push 20. So, the next value will be pushed on the top.

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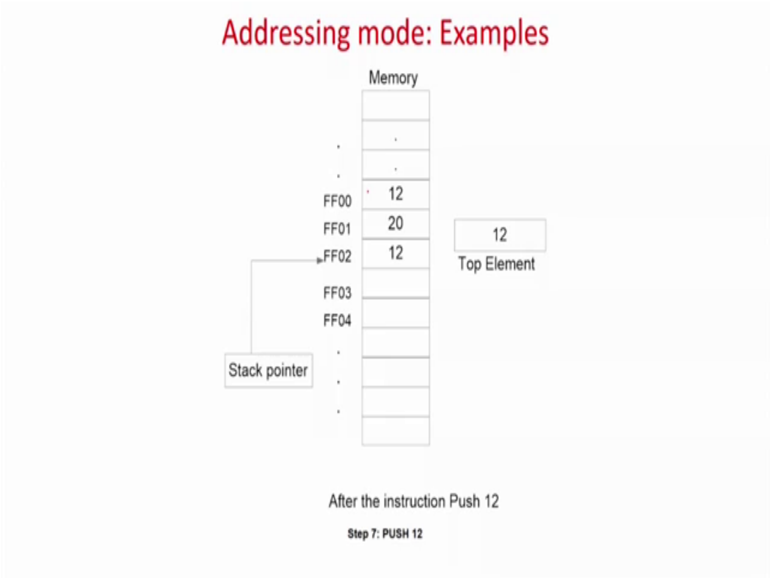

Addressing mode: Examples

After the instruction Push 12

Step 7: PUSH 12

Then the next instruction is push 12, again I pushed on 12 very very simple operation. Stack version is one of the simplest computing that is available over here only thing is that it is slower to do it. Because in fact, you can to do any two operation you have to first push the values and then you have to operate on the last top two elements and the answer will be pushed over here. Slightly slower way of implementation compared to a general computing where you have lots of different modes of instructions different type of instructions etcetera.

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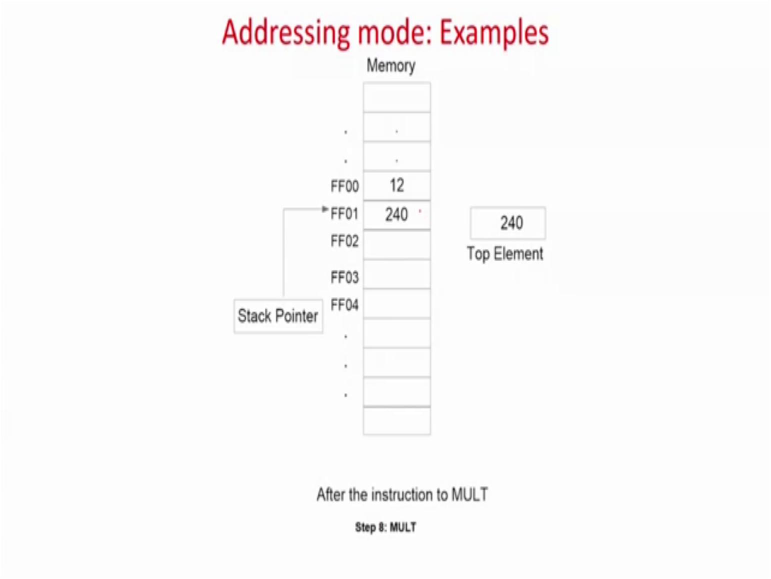

Addressing mode: Examples

After the instruction to MULT

Step 8: MULT

So, I have pushed 12 then this thing multiplied. So, if you multiply it will take the top two elements and multiply it will be 240.

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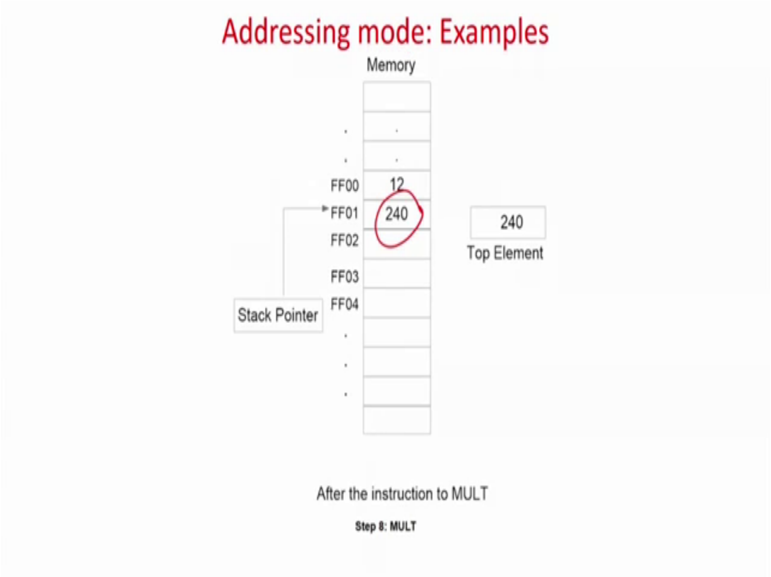

Addressing mode: Examples

After the instruction to MULT

Step 8: MULT

So, 240 will be there over. And then finally as I say subtract some example this will subtract these two values and the value will be put over here.

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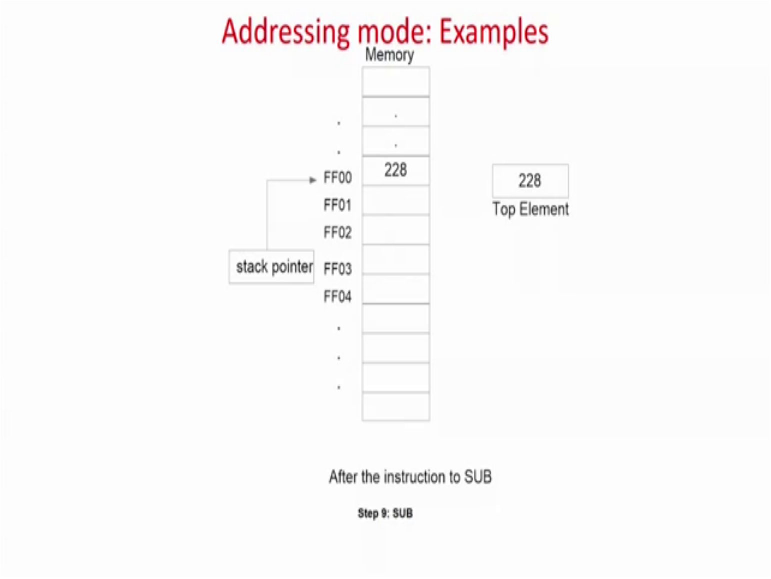

Addressing mode: Examples

After the instruction to SUB

Step 9: SUB

They are just some examples that how basically a stack machine is implemented.

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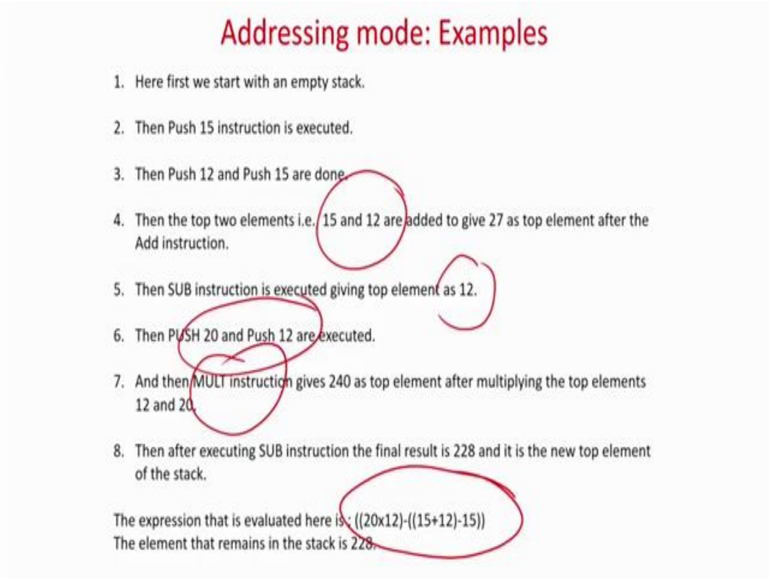

Addressing mode: Examples

1. Here first we start with an empty stack.
2. Then Push 15 instruction is executed.
3. Then Push 12 and Push 15 are done.
4. Then the top two elements i.e. 15 and 12 are added to give 27 as top element after the Add instruction.
5. Then SUB instruction is executed giving top element as 12.
6. Then PUSH 20 and Push 12 are executed.
7. And then MULT instruction gives 240 as top element after multiplying the top elements 12 and 20.
8. Then after executing SUB instruction the final result is 228 and it is the new top element of the stack.

The expression that is evaluated here is : ((20x12)-((15+12)-15))
The element that remains in the stack is 228.

.

Only 3 steps push, pop, and operate. Push means some elements will be pushed, pop means the top elements will be popped out to the memory buffer and operation means you will operate the top two elements.

So, if you look at this slide there discussed it like push 15, push 12 is done. In the top two elements are added. And then you subtract with 12 then again you pushed two elements and then again you multiply and finally, you will see that this is; what is the expression that is actually computed. So, this stack mode of instruction execution is extremely simple compared to all others, but it’s a slower way of doing it ok.

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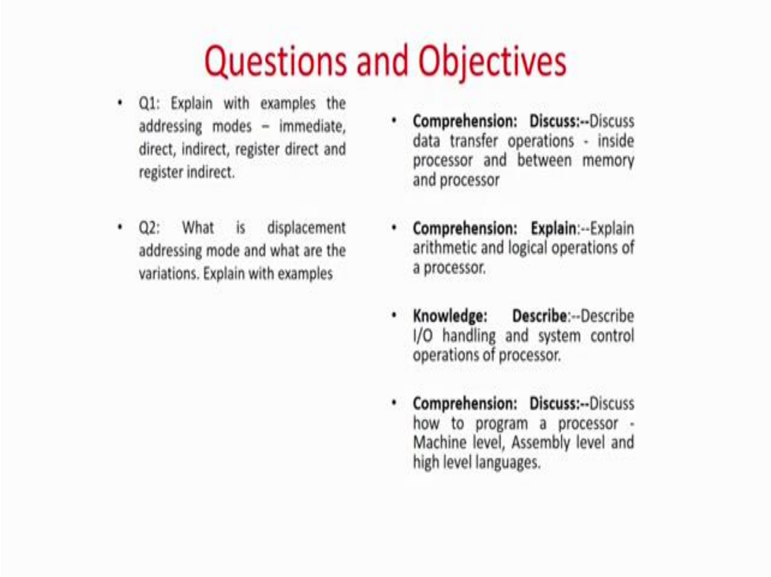

Questions and Objectives

- Q1: Explain with examples the addressing modes – immediate, direct, indirect, register direct and register indirect.
- Q2: What is displacement addressing mode and what are the variations. Explain with examples

- **Comprehension: Discuss:**--Discuss data transfer operations - inside processor and between memory and processor
- **Comprehension: Explain**:--Explain arithmetic and logical operations of a processor.
- **Knowledge: Describe**:--Describe I/O handling and system control operations of processor.
- **Comprehension: Discuss:**--Discuss how to program a processor - Machine level, Assembly level and high level languages.

So, basically this brings us to the end of different addressing modes which we have seen in a wide spectrum from immediate to as long as displacement with index displacement, program counter displacement, base displacement.

So, there is a wide variety of instruction addressing modes available and based on the requirement we choose any one of them. So, towards the end as we have seen let us take very simple examples like explain with example different addressing modes already we have done and it will basically satisfy your objective like explain the discuss if you consider this examples that what we explain with the examples different addressing modes what are the what is displacement and what it is required. So, if you look at the objectives the questions we have here like other the two questions where what are the different type of addressing modes? What are the examples?

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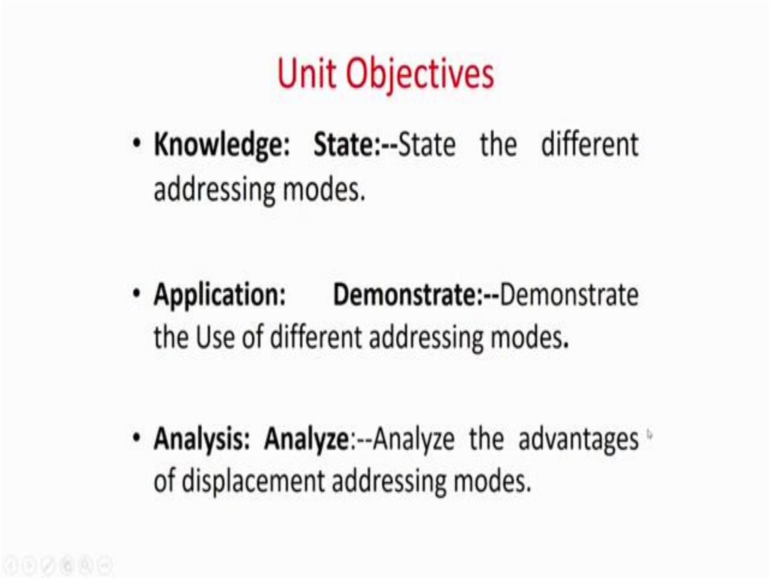

Unit Objectives

- **Knowledge: State:--**State the different addressing modes.
- **Application: Demonstrate:--**Demonstrate the Use of different addressing modes.
- **Analysis: Analyze**:--Analyze the advantages of displacement addressing modes.

So, basically it satisfies the objectives of state the different addressing modes, demonstrate the use of different addressing modes. The second question was if you have referred the question it asked that what are the displacement modes and what it is where it is useful at different type of examples. So, basically it will satisfy the objective of analysis of different type of different type of advantages of different addressing modes.

So just now we have listened to different type of addressing modes like immediate addressing, then what are the other types of addressing modes which are indirect, then basically register and so many variations we have discussed. And now let us look at some simple questions and let us see how it satisfies the objectives we have targeted before starting this unit.

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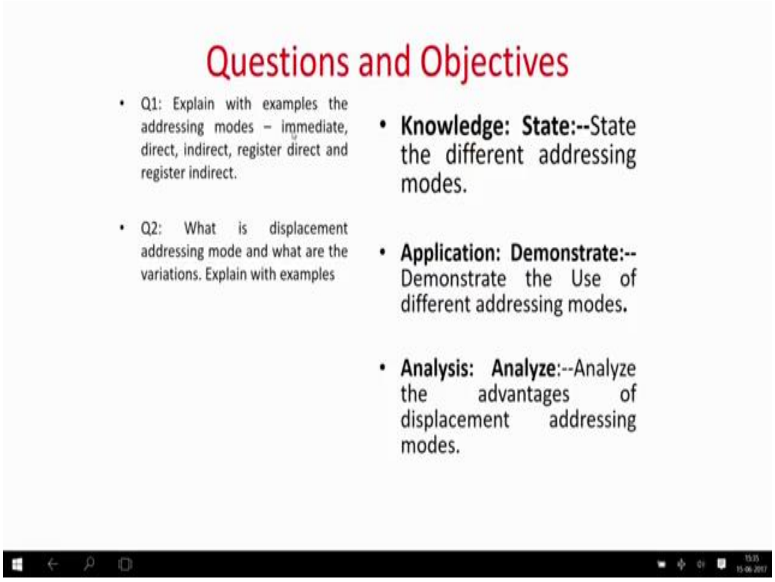

Questions and Objectives

- Q1: Explain with examples the addressing modes – immediate, direct, indirect, register direct and register indirect.
- Q2: What is displacement addressing mode and what are the variations. Explain with examples

- **Knowledge: State:--**State the different addressing modes.
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- **Analysis: Analyze**:--Analyze the advantages of displacement addressing modes.

So, explain with the examples the addressing different type of addressing modes like immediate, direct indirect, so many we have already discussed. So, if you are able to I think with this units of the understanding this unit and with these several examples you have discussed you will be able to solve this problem.

And once solving this problem of course, you will be able to demonstrate the use of different addressing modes and also you will be able to state the knowledge of different addressing modes that is with a whenever you are going to explain somebody the different type of addressing modes basically. And the advantages and disadvantages you will be able to meet the objectives of stating the different type of addressing mode, demonstrating the different type of addressing modes with examples and also analyzing the advantages and disadvantages of it.

And already we have seen apart from the normal instruction modes addressing modes there is something called displacement that is from the one part we can easily go to another part based on indexing the generating effective address space based on one part of the instruction by adding it with the explicit addressing and so forth.

So, if the second problem says that what are the displacement addressing modes different types like index, index, base register etcetera and explaining with that examples and what are the advantages and disadvantages of course this will try to this will be helping you to solve the objective on analysis, analyze the advantages of displacement addressing modes compared to the other addressing other addressing modes like immediate direct and so forth.

So, just by completing this object unit you will be able to state demonstrate and analyze the advantages and different advantage disadvantages of different addressing modes, the cost, what we achieved and how complicated is one addressing mode than the other, but what it gains.

So, basically this brings us to the end of this unit and next unit what you are going to see is that basically what are the instructions we have seen till now are mainly sequential 1 2 3 and so forth. But in a program the basic logic comes if based on some condition you will do either this or you will do either that without this no program is complete or in fact, no program can be built without certain condition and logic.

So, the next unit we will be focusing on conditional statements, flags, how a conditional code executes that if it is true you do this and so forth. So, we will be next unit we will be looking at the flags and conditional instructions.

Thank you.