

Computation Structures 2: Computer Architecture

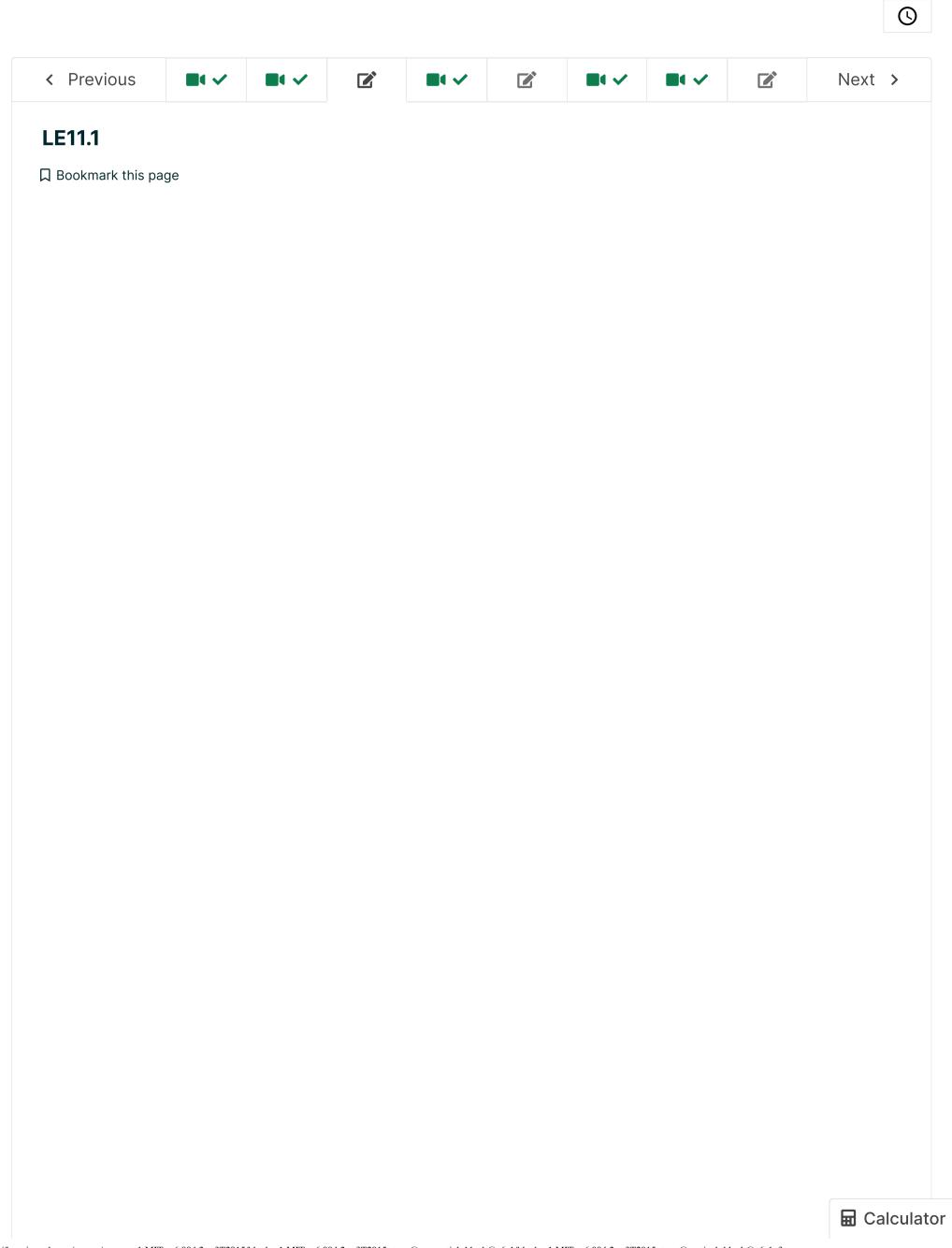
<u>Help</u>





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☆ Course / 11. Compilers / Lecture Videos (34:57)



LE11.1.1 Expressions

O points possible (ungraded)

Hand-compile the following C fragments into Beta assembly language. You can also assume that all variables and arrays are C integers, i.e., 32-bit values, and that the necessary storage allocation for each variable or array has been done and that a UASM label has been defined that indicates the first storage location for that variable or array.

There's no automated checking for this problem. Just write your answer out on a piece of paper and then compare it with the solutions to see how you did!

```
(A) x = 3;
```

Explanation

Using templates:

```
CMOVE(3,r0)
ST(r0,x)
```

(B) d = b + 3*c; [Note: in C, multiplication has a higher precedence than addition, so C treats this expression as "b+(3*c)".]

Explanation

Using templates (optimizations possible):

```
LD(b,r0)
CMOVE(3,r1)
LD(c,r2)
MUL(r1,r2,r1)
ADD(r0,r1,r0)
ST(r0,d)
```

```
(C) d = (b*3 + 1)/(c - b);
```

Explanation

Using templates (optimizations possible):

```
LD(b,r0)
                // b
CMOVE(3,r1)
MUL(r0,r1,r0)
               // b*3
CMOVE(1, r1)
ADD(r0,r1,r0)
              // b*3 + 1
               // c
LD(c,r1)
               // b
LD(b,r2)
SUB(r1,r2,r1) // c - b
              // (b*3 + 1)/(c - b)
DIV(r0,r1,r0)
ST(r0,d)
```

(D) a[1] = a[0] + 1; [Note: in C, the first element of an array has index 0. Remember that each element of the "a" array occupies 4 bytes (i.e., bsize = 4).]

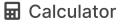
Explanation

Using templates (optimizations possible):

```
(E) a[j-1] = a[j] + 1;
```

Explanation

Using templates (optimizations possible):



```
LD(j,r0)
MULC(r0,4,r0)  // convert index to byte offset
LD(r0,a,r0)
CMOVE(1,r1)
ADD(r0,r1,r0)
LD(j,r1)
CMOVE(1,r2)
SUB(r1,r2,r1)
MULC(r1,4,r1)
ST(r0,a,r1)
```

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• Answers are displayed within the problem

LE11.1.2 Array access

0.0/1.0 point (ungraded)

What C statement might have been compiled into the code fragment below?

```
I = 0x5678
B = 0x1234

LD(I,R0)
SHLC(R0,2,R0)
LD(R0,B,R1)
MULC(R1,17,R1)
ST(R1,B,R0)
```

```
\bigcirc B[I] = B[I] * 17
```

```
\bigcirc B[I] = B[I*17]
```

$$\bigcirc B[I] = B[4*I]*17$$

$$\bigcirc B[I] = B[4*I*17]$$

Submit

LE11.1.3 Array access

0.0/1.0 point (ungraded)

For each of the assembly language sequences below, click the associated box if it might have resulted from compiling the following C statement.

```
int x[20];
int y;
y = x[1] + 4;
```

A: LD(R31,x+1,R0)	
ADDC(R0,4,R0)	
ST(R0,y,R31)	

☐ Calculator

	10VE(4,R0)	
AD		
	DDC(R0, x+4, R0)	
Sī	Γ(R0,y,R31)	
C: L	O(R31,x+4,R0)	
S1	Γ(R0,y+4,R31)	
D: CN	10VE(4,R0)	
	D(R0,×,R1)	
	Γ(R1,y,R0)	
\neg		
)(P31 V±4 P0)	
	D(R31,x+4,R0) DDC(R0,4,R0)	
	Γ(R0,y,R31)	
	· ····· , , , ······· ,	
	DDC/D244 D0)	
	DDC(R31, x+1, R0)	
	DDC(R0,4,R0)	
67	Γ/DA ν D21)	
	Γ(R0,y,R31)	
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