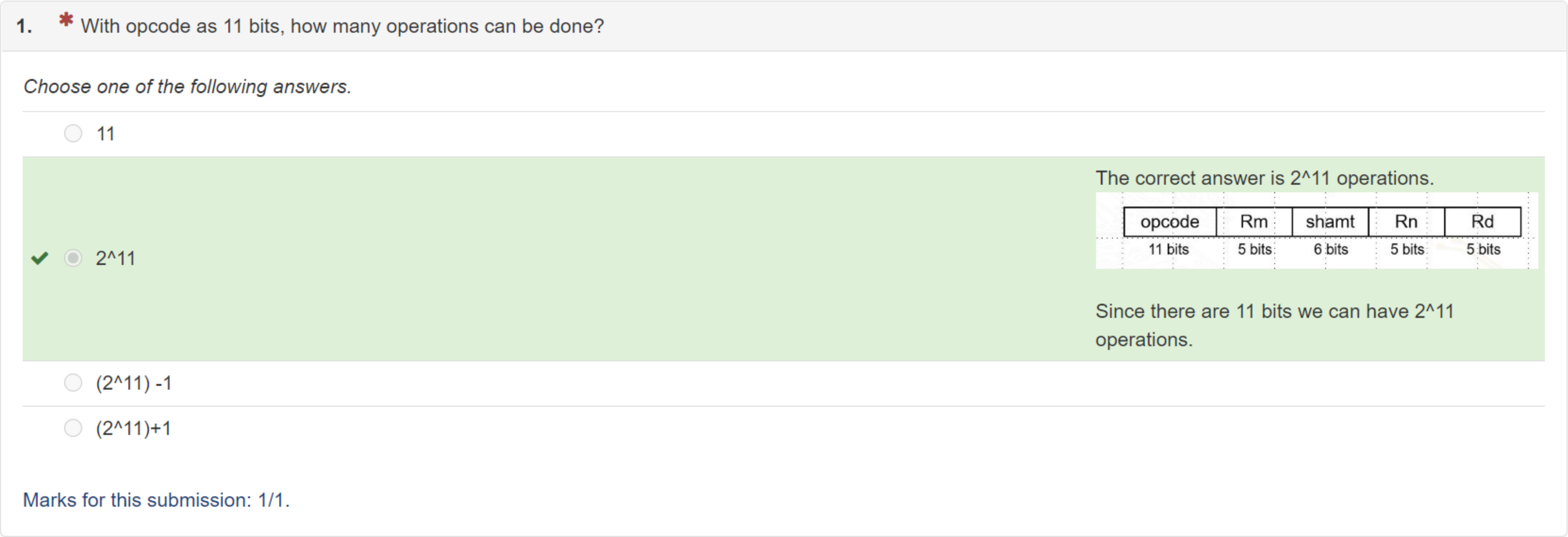
CZ3001
Advanced Computer Architecture

LAMS 3 – Datapath: Single cycle



1. * With opcode as 11 bits, how many operations can be done?

Choose one of the following answers.

○ 11

✓ ● 2^11

The correct answer is 2^11 operations.

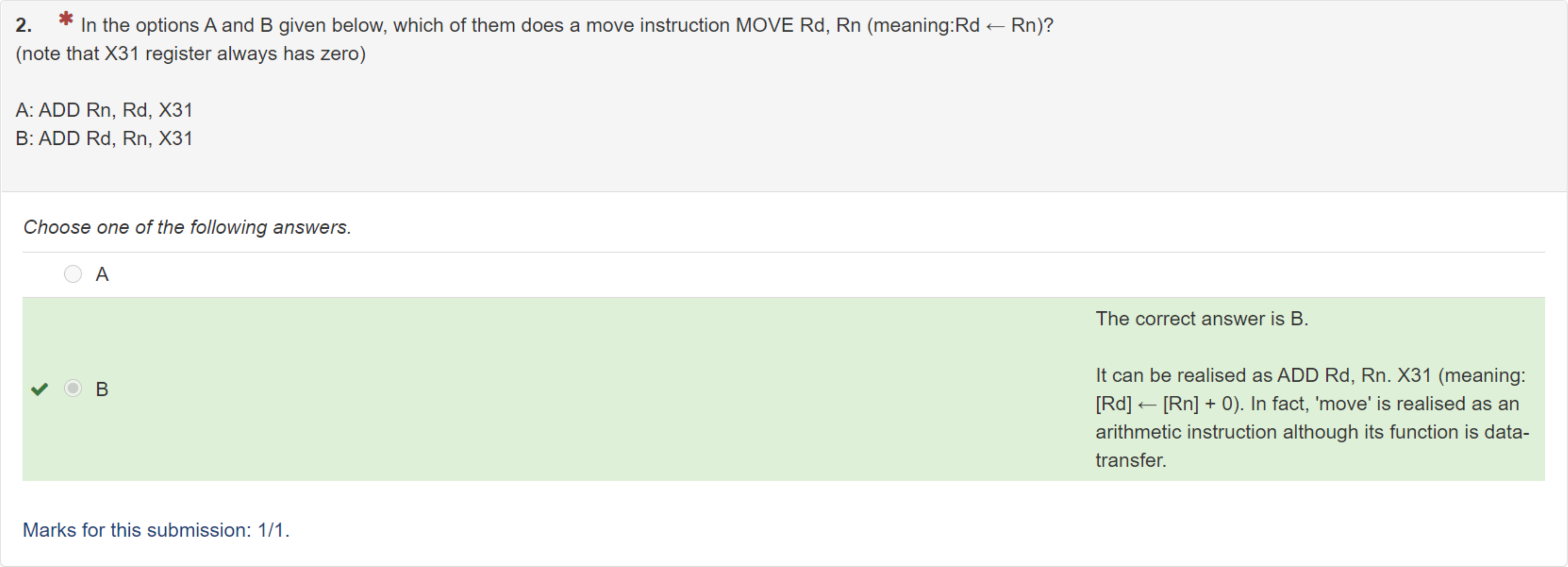
opcode	Rm	shamt	Rn	Rd
11 bits	5 bits	6 bits	5 bits	5 bits

Since there are 11 bits we can have 2^11 operations.

○ (2^11) -1

○ (2^11)+1

Marks for this submission: 1/1.



2. * In the options A and B given below, which of them does a move instruction MOVE Rd, Rn (meaning:Rd ← Rn)? (note that X31 register always has zero)

A: ADD Rn, Rd, X31
B: ADD Rd, Rn, X31

Choose one of the following answers.

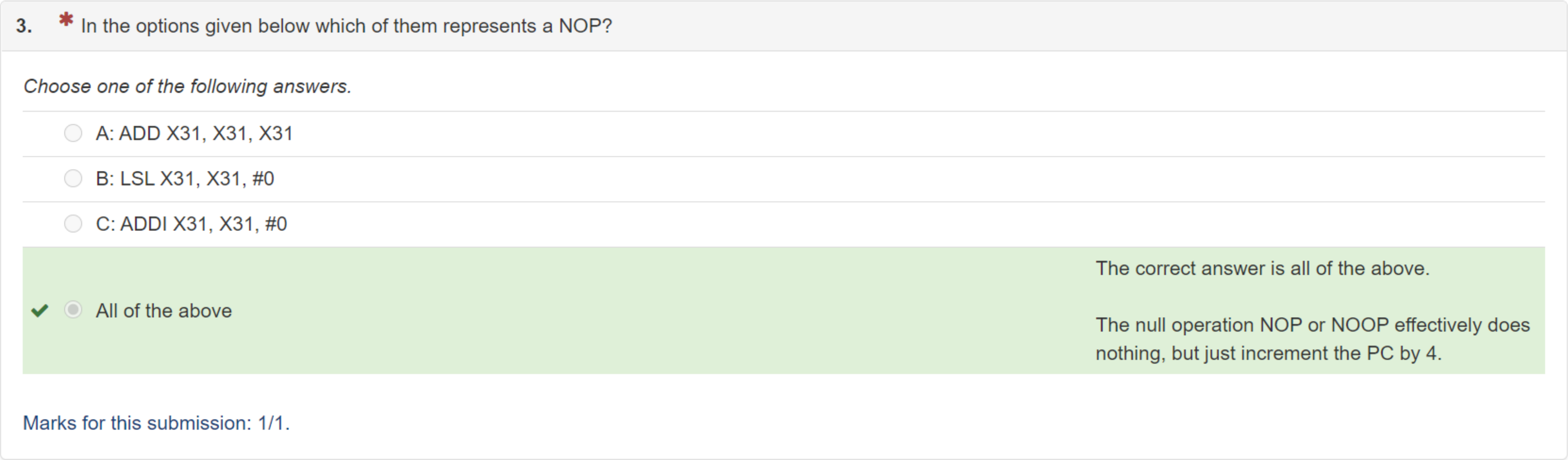
○ A

✓ ● B

The correct answer is B.

It can be realised as ADD Rd, Rn. X31 (meaning: [Rd] ← [Rn] + 0). In fact, 'move' is realised as an arithmetic instruction although its function is data-transfer.

Marks for this submission: 1/1.



3. * In the options given below which of them represents a NOP?

Choose one of the following answers.

○ A: ADD X31, X31, X31

○ B: LSL X31, X31, #0

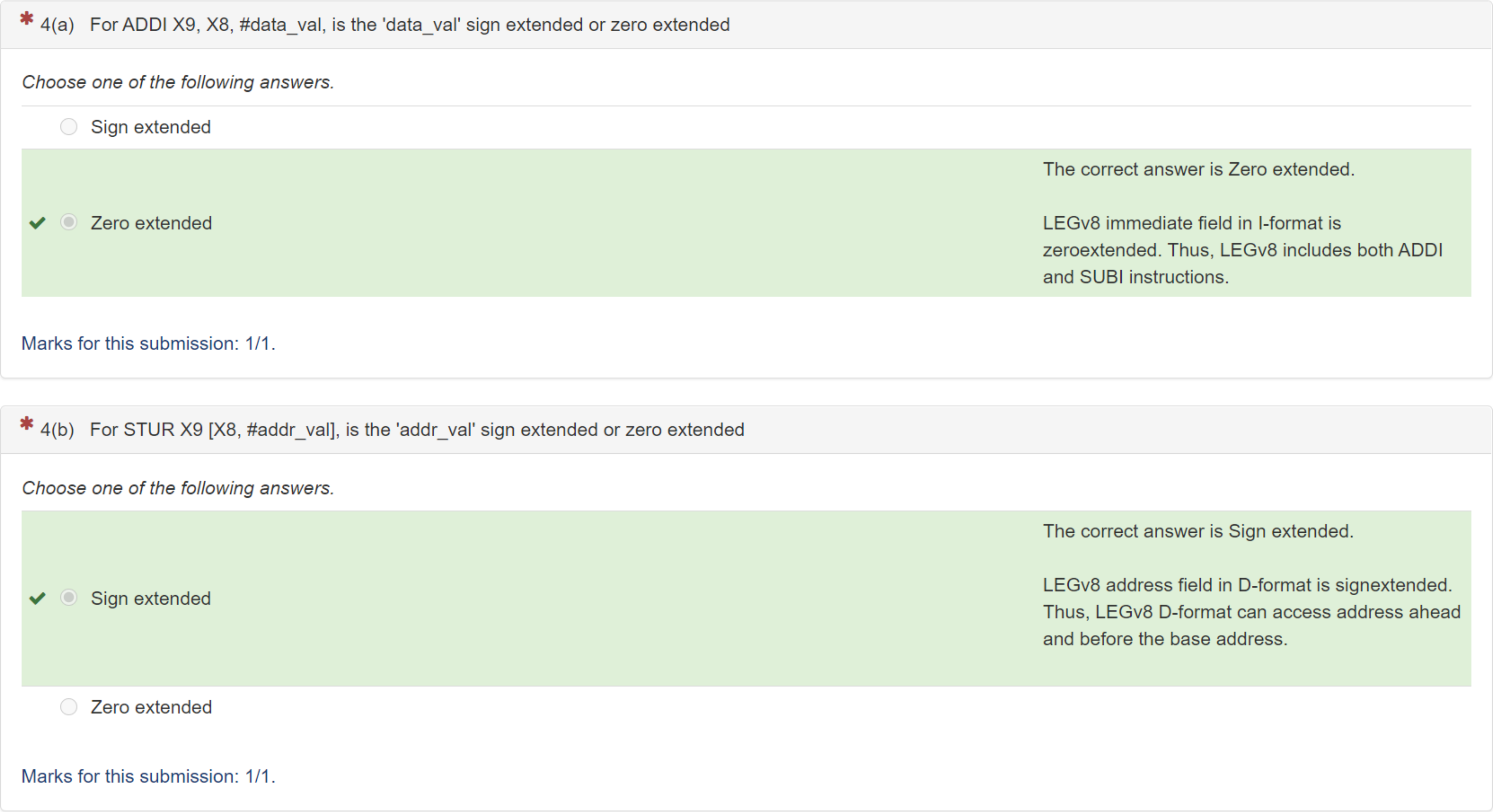
○ C: ADDI X31, X31, #0

✓ ● All of the above

The correct answer is all of the above.

The null operation NOP or NOOP effectively does nothing, but just increment the PC by 4.

Marks for this submission: 1/1.



* 4(a) For ADDI X9, X8, #data_val, is the 'data_val' sign extended or zero extended

Choose one of the following answers.

○ Sign extended

✓ ● Zero extended

The correct answer is Zero extended.

LEGv8 immediate field in I-format is zeroextended. Thus, LEGv8 includes both ADDI and SUBI instructions.

Marks for this submission: 1/1.

* 4(b) For STUR X9 [X8, #addr_val], is the 'addr_val' sign extended or zero extended

Choose one of the following answers.

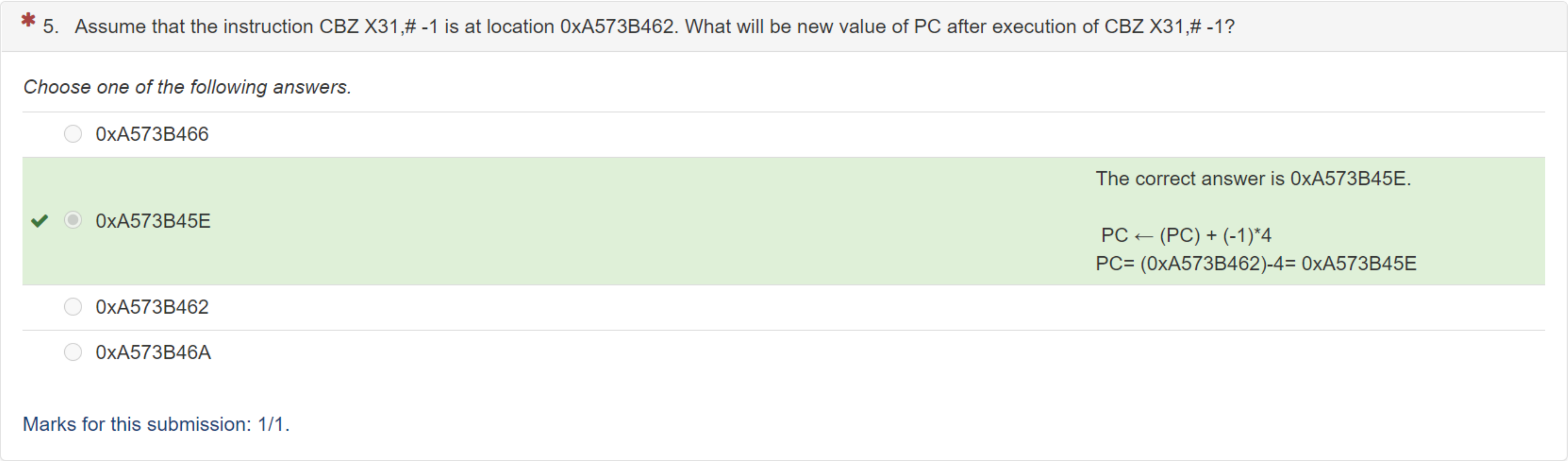
✓ ● Sign extended

The correct answer is Sign extended.

LEGv8 address field in D-format is signextended. Thus, LEGv8 D-format can access address ahead and before the base address.

○ Zero extended

Marks for this submission: 1/1.



* 5. Assume that the instruction CBZ X31,# -1 is at location 0xA573B462. What will be new value of PC after execution of CBZ X31,# -1?

Choose one of the following answers.

○ 0xA573B466

✓ ● 0xA573B45E

The correct answer is 0xA573B45E.

PC ← (PC) + (-1)*4
PC= (0xA573B462)-4= 0xA573B45E

○ 0xA573B462

○ 0xA573B46A

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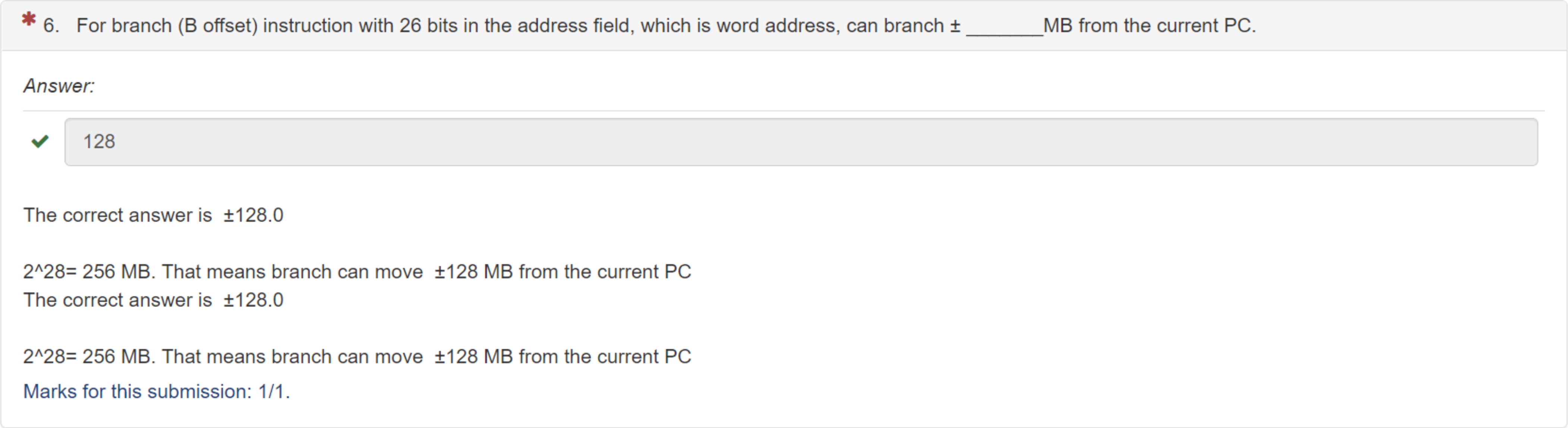

* 6. For branch (B offset) instruction with 26 bits in the address field, which is word address, can branch ± ________MB from the current PC.

Answer:

✓ 128

The correct answer is ±128.0

2^28= 256 MB. That means branch can move ±128 MB from the current PC

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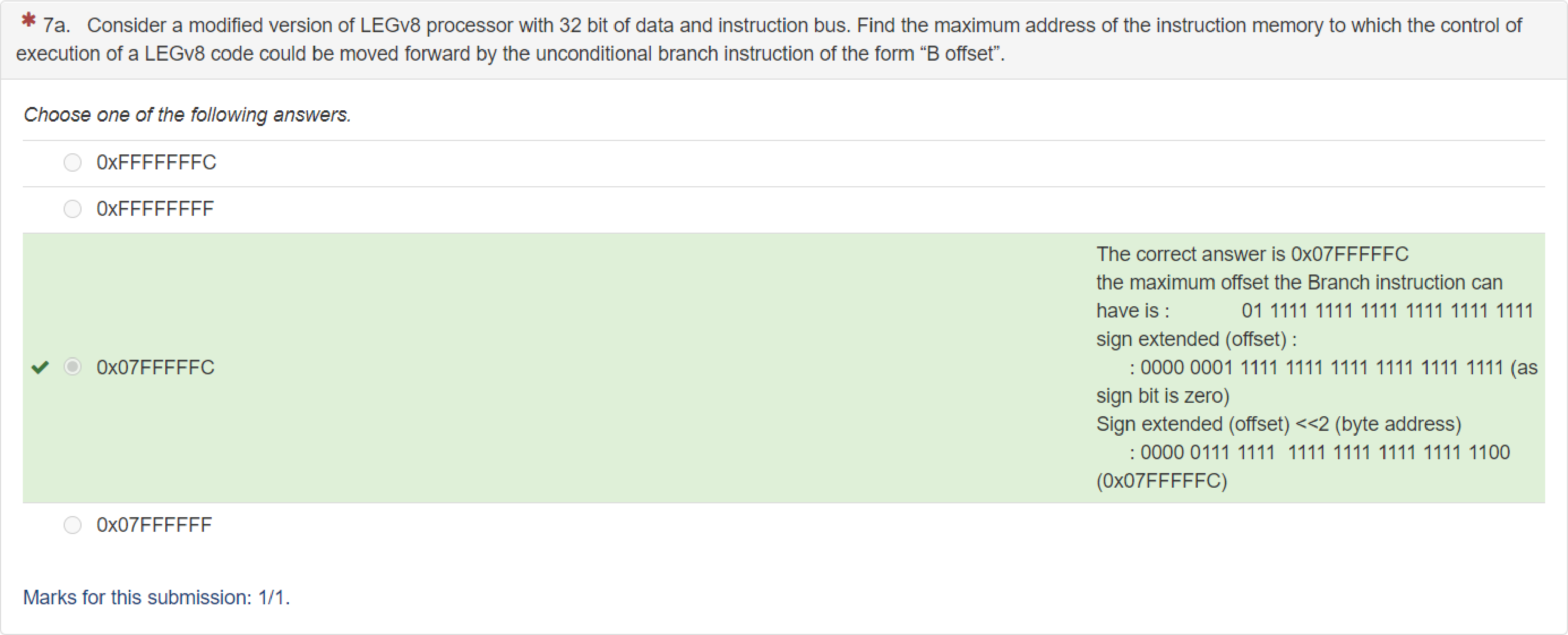


* 7a. Consider a modified version of LEGv8 processor with 32 bit of data and instruction bus. Find the maximum address of the instruction memory to which the control of execution of a LEGv8 code could be moved forward by the unconditional branch instruction of the form “B offset”.

Choose one of the following answers.

○ 0xFFFFFFFC

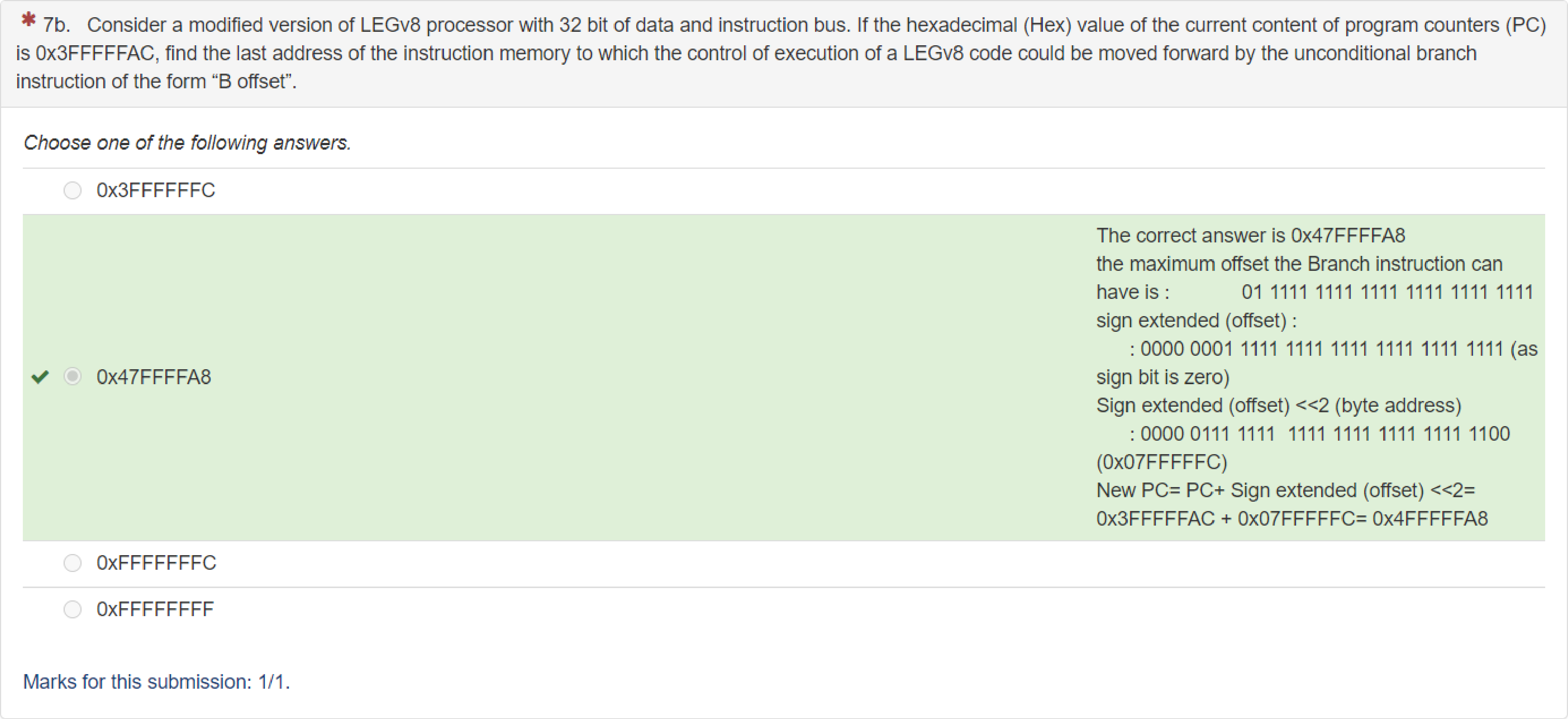
○ 0xFFFFFFFF

✓ ● 0x07FFFFFC

The correct answer is 0x07FFFFFC
the maximum offset the Branch instruction can have is : 01 1111 1111 1111 1111 1111 1111
sign extended (offset) :
: 0000 0001 1111 1111 1111 1111 1111 1111 (as sign bit is zero)
Sign extended (offset) <<2 (byte address)
: 0000 0111 1111 1111 1111 1111 1111 1100 (0x07FFFFFC)

○ 0x07FFFFFF

Marks for this submission: 1/1.



* 7b. Consider a modified version of LEGv8 processor with 32 bit of data and instruction bus. If the hexadecimal (Hex) value of the current content of program counters (PC) is 0x3FFFFFAC, find the last address of the instruction memory to which the control of execution of a LEGv8 code could be moved forward by the unconditional branch instruction of the form “B offset”.

Choose one of the following answers.

○ 0x3FFFFFFC

✓ ● 0x47FFFFA8

The correct answer is 0x47FFFFA8
the maximum offset the Branch instruction can have is : 01 1111 1111 1111 1111 1111 1111
sign extended (offset) :
: 0000 0001 1111 1111 1111 1111 1111 1111 (as sign bit is zero)
Sign extended (offset) <<2 (byte address)
: 0000 0111 1111 1111 1111 1111 1111 1100 (0x07FFFFFC)
New PC= PC+ Sign extended (offset) <<2=
0x3FFFFFAC + 0x07FFFFFC= 0x4FFFFFA8

○ 0xFFFFFFFC

○ 0xFFFFFFFF

Marks for this submission: 1/1.