LE12.3

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LE12.3.1 Stack Detective

13/13 points (ungraded)

You are given the following incomplete listing of a C program and its translation to Beta assembly code:

```
int ones(int x) {
  int lowbit = x & 1;    // low bit of x
  int rest = x >> 1;     // shift other bits right
  if (x == 0) return 0;
  else return ???;
}
```

```
ones:  PUSH(LP)
       PUSH(BP)
       MOVE(SP, BP)
       ALLOCATE(2)
       PUSH(R1)
       LD(BP, -12, R0)
       ANDC(R0, 1, R1)
       ST(R1, 0, BP)
       SHRC(R0, 1, R1)
       ST(R1, 4, BP)

xx:    BEQ(R0, labl)

zz:    LD(BP, 4, R1)
       PUSH(R1)
yy:    BR(ones, LP)
       DEALLOCATE(1)
       LD(BP, 0, R1)
       ADD(R1, R0, R0)

labl:  POP(R1)

       MOVE(BP, SP)
       POP(BP)
       POP(LP)
       JMP(LP)
```

1. Fill in the binary value of the instruction stored at the location tagged **xx** in the above assembly-language program.

   opcode (6 bits): 0b 011100 ✔

   Rc (5 bits): 0b 11111 ✔

   Ra (5 bits): 0b 00000 ✔

   literal (16 bits): 0b 0000000000000 ✔

2. What is the missing C source corresponding to the **???** in the above listing?

   - ( ) ones(rest + lowbit)
   - ( ) lowbit
   - ( ) ones(rest)
   - (•) ones(rest) + lowbit ✔

3. Suppose the instruction bearing the tag **zz** were eliminated from the assembly language program. Would the program continue to work?

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- (●) Yes
- ( ) No

✔

The procedure **ones** is called from an external procedure and its execution is interrupted just prior to the execution of the instruction tagged **xx**. The contents of a region of memory are shown to the left.

NB: All addresses and data values are shown in hex. The contents of **BP** are 0×1C8, and **SP** contains 0×1D4.

Address in Hex	**Contents in Hex**
184:	4
188:	7
18C:	47
190:	$C4$
194:	$D4$
198:	1
19C:	23
1A0:	22
1A4:	23
1A8:	$4C$
1AC:	198
1B0:	1
1B4:	11
1B8:	23
1BC:	11
1C0:	$4C$
1C4:	$1B0$
BP→1C8:	1
1CC:	8
1D0:	$???$
SP→1D4:	0

4. What was the argument to the *most recent* call to **ones**?

   Most recent argument (HEX): x = 0x [11] ✔

5. What is the missing value marked **???** for the contents of location 1D0?

   Contents of 1D0 (HEX): 0x [11] ✔

6. What is the hex address of the instruction tagged **xx**?

   Address of xx (HEX): xx = 0x [38] ✔

7. What was the argument of the *original* call to **ones**?

   Original argument (HEX): x = 0x [47] ✔

8. What is the hex address of the BR instruction that called ones originally?

   Address of original call (HEX): 0x [C0] ✔

9. What were the contents of R1 at the time of the original call?

   Original R1 contents (HEX): R1 = 0x [22] ✔

10. What value will be returned to the original caller?

    Return value for original call (HEX): 0x [4] ✔

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- Need HELP setting up BSim for this ex — 12
  According to problem the hex addrs of the BR that called **ones(0x47)** is C0; ——> So why this does not work? get Halt() right aw...
- What were the contents of R1 at the time of the original call? — 2
  The original R1 is stored after the two local variables in the stack frame, so it can be found at BP + 8 in the top stack frame. This is lo...

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