Show all work! Correct answer alone will get 0 point!

1.)

a.

Assume you are given the binary number 0101010110110000 in 16-bit CodeMill floating-point representation. (1 bit for Sign, 4-bit for Exponent, 11-bit for Mantissa)

What is the corresponding value in decimal?

Answer: ________________________

b.

Convert -3.2 decimal to 12-bit floating point representation. (1 bit for Sign, 3-bit for Exponent, 8-bit for Mantissa)

Answer: ________________________ in HEX
2.)

Given the following expression ( ( ( a + b ) – c ) + ( d – e ) ) – f ),

a. Neatly draw the binary tree representing the expression above.

b. Write the equivalent post-order and pre-order expression.

Post: _____________________________________

Pre:  ______________________________________

c. Write the CodeMill instructions to compute the value of the expression for **post-order**. Assume all variables (a,b,c,...) are already defined. HLT instruction written for you.

HLT;
3.)

Assume the stack looks like the following:

a. We want to read value C from stack (i.e. copy C to some register). What is the minimum number of CodeMill instructions to perform the task? ______________

b. Assume A = 3, B = 2, C = 1 in the stack above. Trace through the following program.

```
ADS;
NES;
POP R1;
LDI R0, 5;
PUS R0;
SUS;
INC R0;
PUS R0;
EXC; /* swap top two values on stack */
PUS R1;
ADS;
PUS R0;
```

What are the values of the first 3 items on stack after execution of the program?

1. __________
2. __________
3. __________
4.)

Trace through the given recursive program in CodeMill and find the results of R0 and R2.

```assembly
n: 5;
LDI R2, n;
JSR function1;
HLT;

function1:
   JCD R2, =, 1, return;
PUS R2;
DEC R2;
JSR function1;
POP R0;
ADD R2, R0;
RTS;

return: LDI R2, 1;
RTS;
```

What are the values of R0 and R2 at the HLT instruction?

R0: __________
R2: __________

What about if n = 6 (instead of 5)?

R0: __________
R2: __________
5.) Write an iterative CodeMill program to compute the linear recurrence

\[ f(n) = f(n-2) + f(n-3); \ f(1) = f(2) = f(3). \] Assume that \( n = 10 \).

How many CodeMill instructions will the computer execute to run your program for \( n = 10 \). Generalize your answer to any \( n \).