1. WRITE the shortest possible VALID C program. (Here, valid means acceptable to the compiler. The program does not have to be useful, nor does it have to follow any of this course’s rules for programming projects.) What does it do when you run it?

2. WHY are integers sometimes called fixed point numbers?

3. WHY are real numbers sometimes called floating point numbers?

4. Numeric literal constants can be used in several ways, some of which are good programming practice and some of which are bad programming practice. MARK each of the following uses as either GOOD or BAD.
   (a) const int feet_per_fathom = 6;
   (b) float height_in_m = 1.6;
   (c) snow_depth_in_inches = 2;
   (d) degrees_fahrenheit = degrees_celsius * (9.0 / 5.0) + 32.0;

5. WHY can C only approximate most (mathematical) real numbers?

6. On a Linux PC under the GNU gcc compiler (the compiler being used in this course), HOW MANY BITS are in an int? Therefore, HOW MANY DIFFERENT POSSIBLE VALUES could an int variable represent?

7. On a Linux PC under the GNU gcc compiler (the compiler being used in this course), HOW MANY BITS are in a float by default? Therefore, HOW MANY DIFFERENT POSSIBLE VALUES could a float variable of the default number of bits exactly represent?
8. Consider each of these values. **MATHEMATICALLY**, does it represent an integer? **EXPLAIN.**

(a) \(344513.0000000000000000000000000000\)

(b) \(344513.0000000000000000000000000001\)

(c) \(-1281023984\)

(d) \(-6/3\)

(e) \(+9/5\)

(f) \(1 \cdot 10^{18}\)

9. Consider each of these numeric literal constants. **COMPUTATIONALLY**, does it represent an integer? **EXPLAIN.**

(a) \(344513.0000000000000000000000000000\)

(b) \(344513.0000000000000000000000000001\)

(c) \(-5281023984\)

(d) \(1E+15\)

10. **NAME THREE REASONS** why computers use both integers and real numbers.

(a)

(b)

(c)
11. **GIVE TWO EXAMPLES** of unary arithmetic operations (NOT operators).
   (a) 
   (b) 

12. For the two examples of unary arithmetic operations, above, **WHAT ARE THE ASSOCIATED OPERATORS?**
   (a) 
   (b) 

13. **GIVE TWO EXAMPLES** of binary arithmetic operations (NOT operators).
   (a) 
   (b) 

14. For the two examples of binary arithmetic operations, above, **WHAT ARE THE ASSOCIATED OPERATORS?**
   (a) 
   (b) 

15. **WHAT IS THE DIFFERENCE** between dividing an `int` by an `int` and dividing a `float` by a `float`? **BE SPECIFIC AND USE THE CORRECT TERMINOLOGY.**

16. **WHAT IS THE DIFFERENCE** between dividing an `int` by a `float` and dividing a `float` by a `float`? **BE SPECIFIC AND USE THE CORRECT TERMINOLOGY.**

17. **WHY** is the use of numeric literal constants in the body (execution section) of a program considered to be bad programming practice?
18. **WHAT IS THE DATA TYPE** of each of the following literal constants? If the item **ISN'T** a valid literal constant, mark it **INVALID** and **EXPLAIN**.

(a) 2004982098

(b) 2004982098.0

(c) 2,004,982,098

(d) -2004982098

(e) --2004982098

(f) 2004982098-

(g) -3529.3098e+10

(h) -3529.3098e-10

(i) 2e-05

(j) 2.0e-05

(k) 0

(l) 0.0

(m) "Howdy do!"

(n) "Huh?

(o) What do you want?"
19. **WHAT IS THE OUTPUT** of each of these programs? Examine the programs CAREFULLY. If a program won’t compile, mark WON’T COMPILE and EXPLAIN. If a program compiles and runs but does not produce any output, mark NO OUTPUT and EXPLAIN. If a program compiles and runs but produces garbage output, mark GARBAGE and EXPLAIN. If you are not confident of an answer, type in, compile and run the program.

(a) 
```c
#include <stdio.h>
int main ()
{ /* main */
    int x = 5, y = 7, z;
    x = x + 5;
    z = x * y;
    printf("x = %d, y = %d, z = %d\n", x, y, z);
} /* main */
```

(b) 
```c
#include <stdio.h>
int main ()
{ /* main */
    int x = 5, y = 7, z;
    y = y * 5;
    z = x + y;
    printf("%d %d %d\n", x, y, z);
} /* main */
```
20. A C program has the following declarations:

```c
float x = 10.0, y = 5.5, z = 2.1;
int i = 3, j = 5, k = 7, m;
```

EVALUATE each of the following expressions. SHOW YOUR WORK, including the type of each subexpression (indicating a float with a decimal point). If the expression would compile and runs but would produce garbage output, mark GARBAGE and EXPLAIN. If you are not confident of your answer, type in, compile and run an appropriate program.

(a) \( y / x \)

(b) \( i \% j \)

(c) \( k + z \)

(d) \( 100 / i - x \)

(e) \( 324 / m - 12 \)

(f) \( i \% (j - 3) \% 3 \)
21. **WHAT IS THE OUTPUT** of each of these programs, for each of the following inputs? (You do not need to show the output of the greeting nor the prompt message.) Examine the programs **CAREFULLY.** If you are not confident of your answer, type in, compile and run the programs.

(a) \#include <stdio.h>

```c
int main ()
{
    /* main */
    const float standard_deduction = 4150.0;
    const float single_exemption = 2650.0;
    const float tax_rate = 0.15;
    const int tax_year = 1997;

    float income, tax;

    printf("I'm going to calculate the federal income tax\n");
    printf(" on your %d income.\n", tax_year);
    printf("What was your %d income in dollars?\n", tax_year);
    scanf("%f", &income);
    tax = (income - 
    (standard_deduction + single_exemption)) * 
    tax_rate;
    printf("The %d federal income tax on $%2.2f\n", 
    tax_year, income);
    printf(" was $%2.2f.\n", tax);
} /* main */
```

i. 30000

ii. 40000

iii. 100000
(b) #include <stdio.h>

int main ()
{ /* main */
    const float standard_deduction = 4300.0;
    const float single_exemption = 2750.0;
    const float tax_rate = 0.15;
    const int tax_year = 1999;

    float income, tax;

    printf("I’m going to calculate the federal income tax\n");
    printf(" on your %d income.\n", tax_year);
    printf("What was your %d income in dollars?\n", tax_year);
    scanf("%f", &income);
    tax = (income - (standard_deduction + single_exemption)) * tax_rate;
    printf("The %d federal income tax on $%2.2f\n", tax_year, income);
    printf(" was $%2.2f.\n", tax);
} /* main */

i. 30000

ii. 40000

iii. 100000

If you use ANY resources other than Dr. Neeman, the TAs (Ivanov, Kota, Smeltzer, Sunkara), the course textbook or the materials posted on the course webpage, you MUST reference them on the quiz. THIS INCLUDES CLASSMATES, FRIENDS, PROFESSORS, ONLINE RESOURCES, ETC.