

Name: \_\_\_\_\_

Date: \_\_\_\_\_

|           |    |    |    |    |    |       |
|-----------|----|----|----|----|----|-------|
| Question: | 1  | 2  | 3  | 4  | 5  | Total |
| Points:   | 15 | 10 | 10 | 20 | 10 | 65    |
| Score:    |    |    |    |    |    |       |

**Computer representation of integer numbers**

1. Convert the following numbers to decimal representation. Show your work.

(a) (5 points)  $11001100_2$

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(b) (5 points)  $A11_{16}$

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(c) (5 points)  $411_8$

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2. You are developing a new standard for integer arithmetic for microchips. It proposes to store a positive integer number in ten bits.

(a) (5 points) What is the largest number in your system?

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(b) (5 points) How many integer numbers are in your system?

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### Computer representation of floating point numbers

3. (10 points) Mark the statements about IEEE Standard for Floating-Point Arithmetic IEEE754 that are correct.

- ☐ there are at least two different floating point numbers that represent zero
- ☐ there is a floating point number that represents positive infinity
- ☐ there is at least one floating point number that is officially called 'Not a Number' (NaN or nan).
- ☐ the following code fragment

```
1      float x = 0.3, y = 0.4, z = 0.7;  
2      if (x + y == z) {  
3          printf("Equal!\n");  
4      }
```

prints the text string Equal!.

4. You are developing a new standard for floating point arithmetic for microchips. It proposes to store floating point numbers in 14 bits, in a manner similar to IEEE754 standard: one bit for the sign, five bits for the exponent, and (one plus) eight bits for the fractional part of the number. You are **not** reserving special values of the exponent for zero, infinity, and NaN.

(a) (5 points) What is the smallest positive floating point number in your system?

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(b) (5 points) What is the largest floating point number?

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(c) (5 points) Approximately, how many floating point numbers are in your system?

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- (d) (5 points) What is machine  $\epsilon$  in your system?

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**Matlab**

In this section answer the questions “What does the following code do?” using one phrase, e.g. “Finds the square root of two”.

5. (a) (5 points) What does the following Matlab code do?

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```
1 x = 1; while 1+x > 1, x = x/2, pause(.02), end
```

- (b) (5 points) What are the last two values of  $x$  printed?

6. (a) (5 points) What does the following Matlab code do?

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```
1 x = 1; while x+x > x, x = x/2, pause(.02), end
```

- (b) (5 points) What are the last two values of  $x$  printed?