Homework 2

9/9 points earned
(100%)

Quiz passed!

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1 / 1
points

1.
"If you stop at general math, you're only going to make general math money." -
Snoop Dogg

The importance of math

The main emphasis of the homework in this class is helping you learn the math skills
required to flourish in Computer Science. You will find these skills indispensable as
you tackled more and more difficult topics in Computer Science. Remember that the
"Science" part of Computer Science corresponds primarily to Mathematics.

In this homework, we will review some basic topics that you should be familiar with
from high school math.

Functions

The first four questions cover mathematical functions. We recommend that you
review the material on Functions from week 1 before attempting them.

Consider the following Python function:

```
1  def root (a, b, c):
2      discriminant = b ** 2 - 4 * a * c
3      return (-b - discriminant ** 0.5) / (2 * a)
```

Which mathematical function below computes the same value as this function?

$$root(a, b, c) = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Correct Response

$$root(a, b, c) = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$root(a, b, c) = \frac{b - \sqrt{b - 4ac}}{2a}$$

○ $root(a, b, c) = \frac{b - b^2 - 4ac}{2a}$

✓   1 / 1
points

2.

Which of the mathematical functions displayed below are linear?

☑ $f(x) = x + 10$

Correct Response

☑ $g(y) = 2y - 3$

Correct Response

☐ $b(y) = \frac{y+1}{y-1}$

Correct Response
This function is a rational function and not a polynomial function.

☐ $c(z) = \sqrt{z}$

Correct Response
This function is not polynomial.

☑ $h(z) = 3$

Correct Response
Note that a constant function is also linear. In this case, the coefficient for the linear term is zero.

✓   1 / 1
points

3.

As part of this class, we will develop methods for estimating the running time of various important algorithms as functions of the size of their input. One simple function that we will use in these estimates is the logarithm function, which is defined and discussed in Math notes on "Functions".

Review this part of the Math notes. Then compute the logarithm base 5 of $\sqrt{5^7}$ which corresponds to the value of the mathematical expression $\log_5(\sqrt{5^7})$. Enter the answer the box below in decimal form.

> 3.5

Correct Response
Correct.

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1 / 1
points

4.
Significant figures

An important concept in working with numbers is that of significant figures. The significant figures of a number are those digits that carry meaning contributing to its precision. A digit is significant based on the three following rules:

- All non-zero digits are considered significant.

- Zeros appearing anywhere between two non-zero digits are significant.

- Trailing zeros in a number containing a decimal point are significant.

How many significant digits does the decimal number 0.00400100 have?

> 6

Correct Response
Correct. The last two trailing zeroes are significant.

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1 / 1
points

5.

Scientific notation is a way of writing numbers that are too big or too small to be

Scientific notation is a way of writing numbers that are too big or too small to be conveniently written in decimal form. For decimal numbers, scientific notation has the form $a \times 10^b$ where a is a number in the range $1 \leq |a| < 10$ and b is an integer. The number a is the *mantissa* while the integer b is the *exponent*. The mantissa is usually expressed using the same number of significant digits as used in the original decimal form.

What is the mantissa for 0.00400100 when expressed in scientific notation?

☑ $a = 4.00100$

Correct Response
Correct. The two trailing zero are significant in 0.00400100.

☐ $a = 4.001$

Correct Response
Almost. The two trailing zero are significant in 0.00400100.

☐ $a = 0.400100$

Correct Response
The mantissa's absolute value should be greater than or equal to one.

☐ $a = 0.4001$

Correct Response
The mantissa's absolute value should be greater than or equal to one.

✔ 1 / 1
points

6.

In Python, floating point numbers are represented in a binary version of scientific notation where the base 10 is replaced by 2 and the mantissa is a binary number that lies in the range $1 \leq |a| < 2$ and has 53 significant bits. Floating point numbers are usually printed out with up to 12 significant digits (although with trailing zeros suppressed).

In some homework problems, you will be asked to write code that computes an answer as a floating point number and then enter your answer as decimal number with a specified number of significant digits. In practice, Python computes more significant digits than are required so you should round your answer to the closest decimal number with the specified number of significant digits.

For this question, look up (or compute) the decimal representation of the number π and enter the value of π with five significant digits of precision in the box below. Remember to round as describe above.

> 3.1416

Correct Response

Correct. $3.14159...$ rounds up to 3.1416.

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1 / 1
points

7.
Grids

Consider the following code snippet:

```
1  row = ...
2  col = ...
3  nested_list = [[0, 1, 2, 3, 4], [5, 6, 7, 8, 9], [10, 11, 12, 13, 14]]
4
5  print nested_list[row][col]
```

If running this code snippet prints 13 in the console, what are the non-negative values of `row` and `col`? Enter these two values below as numbers separated by a space.

> 2 3

Correct Response

If you missed this question, make sure that the entered values are not reversed.

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1 / 1
points

8.

Review the math notes on Grids. Given a grid of size 4×6, what are the row and column indices for the upper right cell in this grid? Enter the row and columns indices below as numbers separated by a space.

0 5

Correct Response

Review the math notes on "Grids" if you missed this problem.

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1 / 1
points

9.

Review the function `traverse_grid` from the "Grids" video lecture.

Given a 4×4 grid, what values for `start_cell` and `direction` would cause `traverse_grid` to traverse the diagonal of grid connecting the lower right tile to the upper left tile?

○
```
1  start_cell = (3, 0)
2  direction = (0, 1)
```

◉
```
1  start_cell = (3, 3)
2  direction = (-1, -1)
```

Correct Response

Correct.

○
```
1  start_cell = (3, 0)
2  direction = (-1, 0)
```

○
```
1  start_cell = (0, 0)
2  direction = (1, 1)
```