

CSE 280 Challenge Set 09 - Solutions

(c) BYU-Idaho

Instructions: Work on all questions as a group as instructed during class. We will review each answer during class.

Question 1

List the first 5 terms (use fractions instead of decimals) for the following sequences:

- A geometric sequence in which the first value is 1 and the common ratio is $-\frac{1}{2}$.
- An arithmetic sequence in which the first value is 1 and the common difference is $-\frac{1}{2}$.
- A geometric sequence in which the first value is -1 and the common ratio is $-\frac{1}{2}$.
- An arithmetic sequence in which the first value is -1 and common difference is $-\frac{1}{2}$.

Answer:

- $1, -\frac{1}{2}, \frac{1}{4}, -\frac{1}{8}, \frac{1}{16}$
- $1, \frac{1}{2}, 0, -\frac{1}{2}, -1$
- $-1, \frac{1}{2}, -\frac{1}{4}, \frac{1}{8}, -\frac{1}{16}$
- $-1, -\frac{3}{2}, -2, -\frac{5}{2}, -3$

Question 2

Part 1

Evaluate the following:

- $\sum_{i=0}^5 i^2 = 55$
- $\sum_{i=0}^5 i^2 + 3 - 2i = 43$

Part 2

Evaluate the following arithmetic and geometric sums using the closed form formulas:

- $\sum_{i=0}^{99} 3 - 2i = -9600$
- $\sum_{i=0}^{10} 2 \cdot 3^i = 177147$

Formulas:

$$\sum_{i=0}^{n-1} a + id = an + \frac{d(n-1)n}{2}$$

$$\sum_{i=0}^{n-1} a \cdot r^i = \frac{a(r^n - 1)}{r - 1}$$

Question 3

Part 1

After reviewing the following python code, predict what will be displayed.

```
def getValue1(n):
    if n == 0:
        return 2
    if n == 1:
        return 1
    return getValue1(n-1) - getValue1(n-2)

print([getValue1(n) for n in range(20)])
```

Answer: [2, 1, -1, -2, -1, 1, 2, 1, -1, -2, -1, 1, 2, 1, -1, -2, -1, 1, 2, 1]

NOTE: Repeated: 2, 1, -1, -2, -1, 1

Part 2

After reviewing the following python code, predict what will be displayed. Note that `a % b` will return the integer remainder when we divide `a` and `b`. For example:

- `18 % 5 = 3`
- `31 % 13 = 5`
- `8 % 14 = 8`

```
def getValue2(a,b):
    if b == 0:
        return a
    return getValue2(b, a % b)

print(getValue2(12,15))
print(getValue2(64,24))
print(getValue2(17,31))
print(getValue2(121,88))
```

Answer: 3, 8, 1, 11

Part 3

What mathematical problem is the `getValue2` function solving?

Answer: Find the greatest common divisor of a and b

Question 4

What activity does the following recurrence relation perform:

$$F(A, B, [First|Rest]) = \begin{cases} B + F(A, B, Rest) & \text{if } First == A \\ First + F(A, B, Rest) & \text{else} \end{cases}$$

$$F(A, B, []) = []$$

Answer: Replace A with B in a word or list