1 Introduction

Problem Solutions

6E

Problem 1.1 BA Write a program with the following requirements:

a. It defines variables for the following quantities:

$$x = 5.2 + j3.4, \quad y = -17, \text{ and } \quad z = 0.02,$$

where j is the imaginary number $\sqrt{-1}$.

b. It computes and prints the following quantities:

$$x + y, \quad xyz, \text{ and } \quad 4x^3 - 8xy + 6y^2.$$

c. It further computes and prints the following quantities:

$$|x|, \quad \overline{xy}, \text{ and } \quad \Re(x),$$

where $|\cdot|$ is the absolute value, $\overline{\cdot}$ is the complex conjugate, and $\Re(\cdot)$ is the real part.

Solution 1.1 BA The following program meets the requirements:

```
# a. Define variables
x = complex(5.2, 3.4)
y = -17
z = 0.02

# b. Compute and print specified quantities
print(f"x + y = {x + y}")
print(f"xyz = {x*y*z:.1f}")
print(f"4x^3 - 8xy + 6y^2 = {4*x**3 - 8*x*y + 6*y**2:.1f}")

# c. Compute and print further specified quantities
print(f"|x| = {abs(x)}") # Built-in abs() function
print(f"conj xy = {(x*y).conjugate()}")
print(f"Re(x) = {x.real}")
```

This program prints the following to the console:

```
x + y = (-11.8+3.4j)
xyz = -1.8-1.2j
4x^3 - 8xy + 6y^2 = 2282.3+1408.4j
|x| = 6.212889826803627
conj xy = (-88.4+57.8j)
Re(x) = 5.2
```

Problem 1.2 SB Write a program with the following requirements:

a. It defines a variable for a list with the following elements:

```
4, -12, 6, -14, 8, -16
```

b. It prints the first and last elements of the list
c. Using list slicing, it prints the first three elements of the list
d. Using list slicing, it prints the last three elements of the list
e. Using list slicing, it prints every other element, starting with the first element
f. It computes and prints the length of the list (consider using the built-in function `len()`)
g. It computes and prints the sum of the list elements (consider using the built-in function `sum()`)

Solution 1.2 SB The following program meets the requirements:

```
# a. Define list l
l = [4, -12, 6, -14, 8, -16]

# b. Print first and last elements
print(f"First element: {l[0]}")
print(f"Last element: {l[-1]}")

# c. First three elements
print(f"First 3 elements: {l[0:3]}")

# d. Last three elements
print(f"Last 3 elements: {l[-3:]}")

# e. Every other element
print(f"Every other element: {l[0::2]}")

# f. Length
print(f"Length: {len(l)}")

# g. Sum
print(f"sum: {sum(l)}")
```

This program prints the following to the console:

```
First element: 4
Last element: -16
First 3 elements: [4, -12, 6]
Last 3 elements: [-14, 8, -16]
Every other element: [4, 6, 8]
Length: 6
sum: -24
```

Problem 1.3 I2 Write a program with the following requirements:

a. It defines a variable for a list with the following elements:

```
32, 41, 58, 34, 24, 53, 46, 41
```

b. It computes and prints the mean of the list items (consider using the built-in `sum()` and `len()` functions)

c. It finds and prints the maximum and minimum values in the list (consider using the built-in `max()` and `min()` functions)

d. It finds and prints the indices of the maximum and minimum values in the list (consider using the `index()` method)

e. It sorts and prints the sorted list (minimum to maximum; consider using the `sort()` method)

Solution 1.3 I2 The following program meets the requirements:

```
# a. Define list l
l = [32, 41, 58, 34, 24, 53, 46, 41]

# b. Mean
m = sum(l)/len(l)
print(f"Mean: {m}")

# c. Max and min
max_ = max(l)
min_ = min(l)
print(f"Max: {max_}; Min: {min_}")

# d. Indices of max and min
# Note: If there is duplication of max or min, the first index is found
print(f"Max Index (first): {l.index(max_)}")
print(f"Min Index (first): {l.index(min_)}")

# e. Sort
l.sort() # Mutates l itself (returns None)
print(f"Sorted: {l}")
```

This program prints the following to the console:

```
Mean: 41.125
Max: 58; Min: 24
Max Index (first): 2
Min Index (first): 4
Sorted: [24, 32, 34, 41, 41, 46, 53, 58]
```

Problem 1.4 X4 Write a function `capital_only()` with the following requirements:

a. It accepts as input a list
b. It checks that all elements are strings (return an error, otherwise)
c. It returns a list (not the same list[1]) without any strings that begin with a capital letter

1. Because a list is mutable, we have to take care not to mutate a list inside a function (unless that is desired).