Characteristics of functional programming

Practice 1

Functional programming avoids _____ by ensuring that functions cannot modify anything outside their _____ environment. Additionally, data structures in functional programming are considered _____, meaning their _____ cannot change during program execution. Unlike procedural programming, functional programming guarantees that calling a function with the same _____ will always produce the same output.

Items:

side effects | local | arguments | immutable | state

Function type

Practice 2

A function has been defined that takes a property postcode as an argument and returns the crime rating for the area as a whole number between 1 and 5.

The function type is in the form `f: A → B`

What **data type** will be substituted for the letter 'A' in the type definition?

What **data type** be substituted for the letter 'B' in the type definition?

Quiz:
STEM SMART Computer Science Week 42

List head and tail: applied 1

Challenge 2

What will be the result of executing the following statements?

```
my_list = [3,4,5,2,4,6]
head(tail(tail my_list))
```

Quiz:
STEM SMART Computer Science Week 42

List head and tail: applied 2

Challenge 2

`my_list` is defined as `[6, 8, 9, 7, 15, 21]`

From the following options, select the statement combining `head` and `tail` functions that will return the number 7 from `my_list`.

- `tail (tail (tail (head my_list)))`
- `head (tail tail tail my_list)`
- `head (tail (tail (tail my_list)))`
- `head tail tail tail my_list`

Quiz:
STEM SMART Computer Science Week 42

Fold: applied

Challenge 2

What is the output from executing the following fold (or reduce) higher-order function?

```
fold (+) 6 [9, 2, 13]
```

You can assume that the `fold` function used is the equivalent to `foldl` as defined in Haskell.

Quiz:
STEM SMART Computer Science Week 42

Combining map and filter functions

Practice 2

What will be returned if this Haskell expression is executed?

```
filter(>10)(map(*2)[5,7,2,10])
```

Quiz:
STEM SMART Computer Science Week 42

Combining map, filter, and fold functions

Practice 2

Gina has written the following Haskell program containing the higher order functions, `map`, `filter`, and `fold`:

```
mylist = [12,34,65,121,23,34]
mylist_map = map (+1) mylist
mylist_filter = filter odd mylist_map
foldl 0 (+) mylist_filter
```

What value or values will be returned when the program is executed?

Quiz:
STEM SMART Computer Science Week 42

Partial application: applied

Challenge 2

A carpet sales company wants to work out the volume of rolls of carpet in its store. A functional programmer writes the following lines of code in Haskell:

```
pi = 3.142
cyl_vol :: Double -> Double -> Double
cyl_vol h r = pi * (r^2)  * h
five_footer = cyl_vol 5
six_footer = cyl_vol 6
```

What will the output (to two decimal places) be when the statement below is executed?

```
five_footer 4
```

Quiz:
STEM SMART Computer Science Week 42

Function composition: applied 2

Challenge 2

Two functions have been defined as follows:

```
fn_A : Integer -> Integer
fn_A x = (x * 3) ^ 2
```

```
fn_B : Integer -> Integer
fn_B y = 4 * (y - 6)
```

What will be the result of the following composition of the two functions, using 2 as the argument?

```
fn_B ∘ fn_A 2
```

Quiz:
STEM SMART Computer Science Week 42

Partial function application and type

Practice 2

Rosa is designing a calculator to determine the amount of paint needed to cover a wall.

The function `wall_paint_area` calculates the total area of a wall given its height and width:

```
wall_paint_area : Float -> Float -> Float
wall_paint_area height width = height * width
```

Part A

A wall is 3.5 meters high and 4.2 meters wide. What will be the result of the following expression?

```
wall_paint_area 3.5 4.2
```

Part B

Rosa has to paint several walls of the same height (2.8 meters) but with varying widths. She partially applies the function to create a new function:

```
height_based_area = wall_paint_area 2.8
```

What is the **type** of the new function `height_based_area`?

Part C

Write the expression using the function `height_based_area` to calculate the area of a wall that is 5.6 meters wide.