CSC148 Worksheet 16 Solution

Hyungmo Gu

April 26, 2020

Question 1

a. The doctests for the base case is

```
1    """
2    >>> nested_list_contains(1,1)
3    True
4    >>> nested_list_contains(1,2)
5    False
6    """
7
```

Using this fact, we can write

```
1    from typing import Union, List
2
3    def nested_list_contains(obj: Union[int, List], item: int) -> bool:
4        """Return whether the given item appears in <obj>.
5        Note that if <obj> is an integer, this function checks whether
6        <item> is equal to <obj>.
7
8        >>> nested_list_contains(1,1)
9        True
10       >>> nested_list_contains(1,2)
11       False
12       """
13
14       if isinstance(self, int):
15           return obj == item
16
```

Listing 1: worksheet_16_q1a_solution

b. Consider the following doctest

```
1    """
2    >>> nested_list_contains([4,2,2,[6,5,7,[8]]],8)
3    True
4    """
5
```

Using the base case from question 1.a, and the basic recursive design recipe, we can conclude the algorithm will behave as follows

1) $4 \to 4 == item? \to$ False

2) $2 \to 2 == item? \to$ False

3) $2 \to$ False

4) $[6,5,7,[8]] \to$ Recursion

     5) $6 \to 6 == item? \to$ False

     6) $5 \to 5 == item? \to$ False

     7) $7 \to 7 == item? \to$ False

     8) $[8] \to$ Recursion

        9) $8 \to 8 == item? \to$ True (function terminates)

11) Function Terminates until the end of recursion

Now, no new parameters other than *obj* and *item* are required, since

1. for the traversing and checking of elements, they are done using the two parameters.

2. for bringing the value 'True' to user, it is done by repeatedly ending the recursive function call early with the value

3. for brining the value 'False' to user, it is done by returning False at the end.

```python
from typing import Union, List


def nested_list_contains(obj: Union[int, List], item: int) -> bool:
    """Return whether the given item appears in <obj>.
    Note that if <obj> is an integer, this function checks whether
    <item> is equal to <obj>.

    >>> nested_list_contains([4,2,2,[6,5,7,[8]]],8)
    True
    >>> nested_list_contains([4,2,2,[6,5,7,[8]]],9)
    False
    """

    if isinstance(self, int):
        return obj == item
    else:
        # ================== (Solution) ======================
        for sublist in obj:
            result = nested_list_contains(sublist, item)

            if result:
```

2

```
23                        return result
24
25                return False
26                # =======================================================
27
```

Listing 2: worksheet_16_q1c_solution

Question 2

a. The doctests for the base case is

```
1        """
2        >>> first_at_depth(1,2)
3        None
4        """
5
```

Using this fact, we can write

```
1        from typing import Union, List, Optional
2
3
4        def first_at_depth(obj: Union[int, List], d: int) -> Optional[int]:
5            """Return the first (leftmost) item in <obj> at depth <d>.
6            Return None if there is no item at depth <d>.
7            Precondition: d >= 0.
8
9            >>> first_at_depth(1,2)
10            None
11            """
12
13            if isinstance(obj, int):
14                return None
15
```

Listing 3: worksheet_16_q2a_solution