Question 1. [5 MARKS]

Read over the definition of this Python function:

```
def c(n):
    """Docstring (almost) omitted."""
    return sum([c(i) for i in n]) if isinstance(n, list) else n
```

Work out what each function call produces, and write it in the space provided.

1. `c(5)`

   5 5

2. `c([])`

   0 sum ([c(i) for i in [ ]])
   sum(0)
   0

3. `c([1, 2, 3.5])`

   6.5 sum ([c(i) for i in [1,2,3.5]])
   sum([6.5])
   6.5

4. `c([1, [2, 3], 4, [5, 6]])`

   21 sum ([c(i) for i in [1,[2,3],4,[5,6]])
   sum([1,sum([c(i) for i in [2,3]]),4,sum([c(i) for i in [5,6]]))
   sum([1,5,4,11])

5. `c([1, [2, 3], 4, [5, [5.5, 42], 6]])` 21

   68.5

Question 2. [5 MARKS]

Read over the declarations of the three **Exception** classes, the definition of **raiser**, and the supplied code for **notice** below. Then complete the code for **notice**, using only **except** blocks, and perhaps an **else** block.

```
class SpecialException(Exception):
    pass

class ExtraSpecialException(SpecialException):
    pass

class UltraSpecialException(ExtraSpecialException):
    pass

def raiser(s: str) -> None:
    """Raise exceptions based on length of s."""
    if len(s) < 2:
        raise SpecialException
    elif len(s) < 4:
        raise ExtraSpecialException
    elif len(s) < 6:
```

```
        raise UltraSpecialException
    else:
        b = 1 / int(s)

def notice(s: str) -> str:
    """Return messages appropriate to raiser(s).

    >>> notice("123456")
    'ok'
    >>> notice("000000")
    'exception'
    >>> notice ("12345")
    'ultraspecialexception'
    >>> notice("123")
    'extraspecialexception'
    >>> notice("1")
    'specialexception'
    """
    try:
        raiser(s)
    # Write some "except" blocks and perhaps an "else" block
    # below that makes notice(...)
    # have the behaviour shown in the docstring above

    except UltraSpecialException:
        return 'ultraspecialexception'
    except ExtraSpecialException:
        return 'extraspecialexception'
    except SpecialException:
        return 'specialexception'
    except Exception:
        return 'exception'
    else:
        return 'ok'
```

Question 3. [5 MARKS]

Read over the declaration of the class **Tree** and the docstring of the function **two_whether**. Then complete the implementation of **two_whether** below. It may be helpful to know that the Python builtin function **any(L)** returns True if list **L** contains at least one True element, and False otherwise.

```
class Tree:
    """Bare-bones Tree ADT"""

    def __init__(self: 'Tree',
```

```
                value: object =None, children: list =None):
        """Create a node with value and any number of children"""

        self.value = value
        if not children:
            self.children = []
        else:
            self.children = children[:] # quick-n-dirty copy of list


def two_whether(t: Tree) -> bool:
    """Return whether at least one value in tree t is 2

    precondition - t is a non-empty tree with number values

    >>> tn2 = Tree(2, [Tree(4), Tree(4.5), Tree(2), Tree(5.75)])
    >>> tn3 = Tree(3, [Tree(6), Tree(7)])
    >>> tn1 = Tree(1, [tn2, tn3])
    >>> two_whether(tn1)
    True
    >>> two_whether(tn3)
    False
    """

    return t.value == 2 or any([two_whether(c) for c in t.children])
```

Question 4. [5 MARKS]

Complete the implementation of **push** in the class **DescendingStack**, a subclass of **Stack**. Notice that you may use **push**, **pop**, and **is_empty**, the public operations of **Stack**, but you may not assume anything about **Stack**'s underlying implementation.

```
from csc148stack import Stack
"""
Stack operations:
    pop(): remove and return top item
    push(item): store item on top of stack
    is_empty(): return whether stack is empty.
"""

class DescendingStack(Stack):
    """A stack of integers in descending order."""

    def push(self: 'DescendingStack', n: int) -> None:
        """Place n on top of stack self provided it is smaller than
```

```
its predecessor.  Otherwise, raise an Exception and leave
stack self as it was before.

precondition - possibly empty self contains only integers

>>> s = DescendingStack()
>>> s. push(12)
>>> s.push(4)
>>> # now s.push(5) should raise Exception
"""

if not self.is_empty():
    last = self.pop()
    Stack.push(self, last)
    if not last > n:
        raise Exception('{} is not smaller than {}'.format(n, last))
Stack.push(self, n)
```

```
if not self.is_empty():
    last = self.pop(n)
    stack.push(self,n)
    if n>= last:
        raise Exception('{} is greater or equal to {}.format(n,last))
stack.push(self,n)
```