1) Given the following Python program:

```python
def twice(n):
    '''(n: int) -> int
    return twice the value of n
    >>> twice(3)
    6
    ...'''
    return 2 * n

def thrice(n):
    '''(n: int) -> int
    return three times the value of n
    >>> thrice(4)
    12
    ...'''
    return twice(n) + n

def main():
    '''driver for multiples program'''
    i = 5
    result = thrice(i)
    print('Result is', result)
    return

main()
```

What would be result of executing this program (Run Module)? (Choose all that apply.)

a) functions twice, thrice, and main would be defined in the global frame

b) the program would execute and Python would print the result: Result is 15

c) the program would execute and Python would report a runtime error: TypeError

d) the program would execute and Python would report a runtime error: NameError

e) the program would execute and Python would print a result: Result is 30
2) If the program were then changed:

```python
def twice(n):
    '''(n: int) -> int
    return twice the value of n
    >>> twice(3)
    6
    '''
    return 2 * n
def thrice(n):
    '''(n: int) -> int
    return three times the value of n
    >>> thrice(4)
    12
    '''
    n = 10
    return twice(n) + n
def main():
    '''driver for multiples program'''
    i = 5
    result = thrice(i)
    print('Result is', result)
    return
main()
```

What would be result of executing this program (Run Module)? (Choose all that apply.)

a) functions `twice`, `thrice`, and `main` would be defined in the global frame

b) the program would execute and Python would print the result: `Result is 15`

c) the program would execute and Python would report a runtime error: `TypeError`

d) the program would execute and Python would report a runtime error: `NameError`

e) the program would execute and Python would print a result: `Result is 30`
3) Given the following Python code:

```python
def qred(n):
    '''(n: int) -> None

    Reports 2 raised to the nth power.
    >>> qred(3)
    8
    >>> qred(0)
    1
    '''
    pass
```

Re-order the following lines of code to replace `pass` and correctly implement the specification given in the docstring:

```python
1    print(r)
2    r = 1
3    return
4        r = r * 2
5    for i in range(n):
```

4) Given the following Python code:

```python
def twice(x):
    '''(x: int) -> int'''
    result = x + x
    return result

def main():
    ''' betting '''
    bet = 20
    raise_bet = twice(bet) + 10
    print('Raise bet:', raise_bet)
    return
```

When `>>> main()` is called in the Shell, which diagram represents the Python call stack after line 3 has been executed?
a) global frame: main → function
twice → function

main: bet → 20

twice: x → 20
    result → 40

b) global frame: main → function
twice → function
    bet → 20

main: x → 40

twice: result → 40

c) global frame: bet → 20
    x → 20
    result → 40

main: raise_bet → 50

twice: x → 40
5) The following code does not execute as expected. What needs to be changed?

```python
1 total = 0
2 astr = 'a b c d e f'
3 i = 0
4 while i < len(astr):
5     if astr[i] == ' ':
6         total += 1
7         i += 1
8 print(total)
```

a) edit line 7: `i += 1` so indent matches if (line 5)
b) edit line 7: `i += 1` so indent matches while (line 4/no indent)
c) edit line 6: `total += 1` so indent matches while (line 4/no indent)
d) `total = 1` replaces `total = 0` (line 1)
e) `i = 1` replaces `i = 0` (line 3)

6-7) Given the following Python code:

```python
def qblue(x):
    '''(x: int) -> ??
    Exam function.
    '''
    count = 0
    while x > 0:
        count += 1
        x = x // 10
    return count
```

6-a) Complete the type contract: ??

6-b) What is the result of executing `qblue(43210)`?

7) Select the correct brief description for function `qblue`:

a) Returns the number of digits in x.
b) Returns the sum of the digits in x.
c) Returns the quotient of x divided by 10.
d) Returns the remainder of x divided by 10.
e) Reverses the digits in x.
8) Given the following Python code:

```python
def qgold_aux(st, v, c):
    '''midterm exam'''
    vstr = ''
    cstr = ''

    for ch in st:
        if ch in v:
            vstr += ch

        if ch in c:
            cstr += ch

    return len(cstr) < len(vstr)

def qgold():
    '''midterm exam'''

    VOWELS = 'AEIOU'
    CONSONANTS = 'BCDFGHJKLMNPQRSTVWXYZ'

    print(qgold_aux('CIS 210', VOWELS, CONSONANTS))

print(qgold_aux('CIS 210', VOWELS, CONSONANTS))
```

What will be printed when `>>> qgold()` is executed?
??
9) Given the following Python code:

```python
def testsNeeded(s):
    '''(s: str) -> int
    ...
    if len(s) != 0:
        prev_item = s[0]
        dup_ct = 1
        high_ct = 1
    else:
        high_ct = 0
        dup_ct = 0

    for i in range(1, len(s)):
        if s[i] == prev_item:
            dup_ct += 1
        else:
            prev_item = s[i]
            if dup_ct > high_ct:
                high_ct = dup_ct
                dup_ct = 1

    if dup_ct > high_ct:
        high_ct = dup_ct

    return high_ct
```

a) `>>> testsNeeded('abc')`

a) 1  b) 2  c) 3  d) infinite loop  e) True

b) `>>> testsNeeded('abbcc')`

a) 1  b) 2  c) 3  d) infinite loop  e) True
10) Given the following Python code:
    def taxable(income, exemptions, STD_EXEMPT, STD_DEDUCT):
        '''
        Adjust gross income (income) to taxable income
        by applying standard deduction and exemptions.
        >>> taxable(20000, 1, 4150, 6500)
        9350
        '''
        taxable_income = income - STD_DEDUCT
        exempt_adjust = STD_EXEMPT * exemptions
        taxable_income = taxable_income - exempt_adjust
        return taxable_income
    
    def est_tax(income, exemptions):
        '''
        Generates an estimate for federal income tax.
        Returns result.
        >>> est_tax(20000, 1)
        1870.0
        '''
        STD_EXEMPT = 4150
        STD_DEDUCT = 6500
        TAX_RATE = .20
        taxable_income = income - STD_DEDUCT
        exempt_adjust = STD_EXEMPT * exemptions
        taxable_income = taxable_income - exempt_adjust
        estimated_tax = taxable_income * TAX_RATE
        print('Estimated tax is:', estimated_tax)
        return

    Which line(s) of code in est_tax could be replaced by
    taxable_income = taxable(income, exemptions, STD_EXEMPT, STD_DEDUCT)?

    ??

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