1. What is the expression for the following expression tree:

```
/  \\
+   ^
* - 4
a  11
5  7
```

a. \(((5 \times (7 + a - 11)) / (4 ^ x))\)
b. \((((5 \times 7)) / (a - 11 / 4)) ^ x)\)
c. \(((5 \times ((7 / a - 11) / 4)) ^ x)\)
d. \(((5 \times 7) + (a - 11)) / (4 ^ x))\)
e. \(5 \times 7 + a - 11 / 4 ^ x)\)
2. What does the following Python code print out:
   
a = ‘I Love CS177’
b = a[:1] + a[4:7]
print(b)

a. lve
b. lve
*c. Ive
d. llve
e. There is an error related to a[:1]
3. What is the output for the following print statement?

```python
s1='spring'
s2='2013'

print (s1[1:5]+ s2[-4:-2])
```

A. sprin20

*B. prin20

C. sprin 20

D. prin201

E. prin 20
4. What is a correct Python encoding for the following binary tree:

A. \( T = \left[ [3,1,2], [15,3,4], [40,-1,-1], [55,-1,-1], [5,-1,-1] \right] \)

B. \( T = \left[ [55,1,2], [15,3,4], [40,-1,-1], [5,-1,-1], [3,-1,-1] \right] \)

C. \( T = \left[ [55,1,2], [40,3,4], [15,-1,-1], [3,-1,-1], [5,-1,-1] \right] \)

D. \( T = \left[ [40,1,2], [55,3,4], [40,-1,-1], [3,-1,-1], [5,-1,-1] \right] \)

*E. \( T = \left[ [55,1,2], [15,3,4], [40,-1,-1], [3,-1,-1], [5,-1,-1] \right] \)
5. What will the following code do?

```python
from graphics import *
win = GraphWin("snippet", 100,100)
cir = Circle(Point(50,50),15)
cir.setFill('red')
cir.draw(win)
```

A       It draws a Rectangle with one corner at 50,50 and another corner at 65,65.
B       It draws a circle with center at 50,50 and a diameter 15.
C       It creates just an empty window of size 100,100.
D       It creates a bouncing ball animation.
E       * It draws a red circle with center at 50,50 and a radius of 15.
6. Convert 25 from base 10 to binary (base2)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1111</td>
</tr>
<tr>
<td>B</td>
<td>10001</td>
</tr>
<tr>
<td>C*</td>
<td>11001</td>
</tr>
<tr>
<td>D</td>
<td>00011</td>
</tr>
<tr>
<td>E</td>
<td>10101</td>
</tr>
</tbody>
</table>
7. Use the following lines of pseudo code to construct an algorithm for finding the sum of all elements in a 2D array.

1. for each item in row
2. sum = sum + item
3. return sum
4. for each row in array
5. sum = 0

A 12345
B 31245
*C 54123
D 24135
E 54231
8. A recursive function is a function that...

A. never contains any loops.
B. never contains any print statements.
*C. calls itself.
D. calls other functions
E. always runs in linear time.
10. You have written three different functions to reverse a string. For example, if the input is "Hello World", the output should be "dlroW olleH". However, one of the functions will not reverse the string. Which function fails to reverse the string and why?

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>def reverse(string):</td>
<td>def reverse(s):</td>
<td>def reverse(s):</td>
</tr>
<tr>
<td></td>
<td>rStr = &quot;&quot;</td>
<td>rStr = s</td>
</tr>
<tr>
<td></td>
<td>for s in string:</td>
<td>n = len(s)</td>
</tr>
<tr>
<td></td>
<td>rStr = s + rStr</td>
<td>if n == 1 or n == 0:</td>
</tr>
<tr>
<td></td>
<td>return rStr</td>
<td>return s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>return reverse(s[1:]) + s[0]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>for i in range(n):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rStr[i] = s[n-i-1]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>return rStr</td>
</tr>
</tbody>
</table>

A. I because s should be the function's input, not string.
B. I because for s in string is not a valid way to iterate over a string.
C. II because the function is recursive.
D. II because we should use = in the if statement instead of ==.
E*. III because we cannot assign to rStr[i].
11. We say that two functions are equivalent if for any input they produce the same output. Consider the following three functions which take integers as input. Which functions are equivalent?

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
</table>
| def funI(x):
  if x == 60:
    print("FOUND 60!")
  if x < 50:
    print("x<50")
  if x >= 50:
    print("x>=50") | def funII(x):
  if x == 60:
    print("FOUND 60!")
  elif x < 50:
    print("x<50")
  elif x >= 50:
    print("x>=50") | def funIII(x):
  if x == 60:
    print("FOUND 60!")
  elif x < 50:
    print("x<50")
  else:
    print("x>=50")

A. All functions I, II, and III are equivalent.
B. I and II are equivalent, but not equivalent to III.
C*. II and III are equivalent, but not equivalent to I.
D. I and III are equivalent, but not equivalent to II.
E. None of the functions are equivalent to each other.
12. You need to iterate over the items in an array of size n. What programming construct should you use?

A. You should use an if loop.
B. You should use an if statement.
C. A while loop would be your best choice.
D*. A for loop would be your best choice.
E. A programming construct is unnecessary in this case.
13. Order the following lines of code to correctly draw a triangle in a window:

1. \texttt{tri = Polygon(Point(x1, y1), Point(x2, y2), Point(x3, y3))}

2. \texttt{win.close()}

3. \texttt{def drawTriangle(w, h, x1, x2, x3, y1, y2, y3):
   \hspace{1em} tri.draw(win)}

4. \texttt{win = GraphWin(“My Window”, w, h)}

*A 3,5,1,4,2
B 3,5,2,1,4
C 1,3,5,4,2
D 5,1,4,2,3*
14. What does the following piece of code do?

def function(w, h):
    win = GraphWin("Getting tired of these yet?", w, h)
    for x in range(1,90):
        px = w * cos(radians(x))
        py = h * sin(radians(x))
        win.plot(px,py)
    win.close()

A Draws a semicircle.

*B Draws a quarter of a circle

C Draws a whole circle

D This function throws an exception
15. If I have a picture that uses 32 bits for each pixel, and the picture is 560MB in size, how many pixels are in the picture?

A 18,350,080 pixels
B 140,000,000 pixels
*C 146,800,640 pixels
D 140,000 pixels
E None of the above
16. What is the running time of the following function?

def function(L, term):
    lo = 0
    hi = len(L) - 1
    while (hi > lo):
        mid = (hi+lo)//2
        if (L[mid] == term):
            return True
        elif (L[mid] > term):
            lo = mid
        elif (L[mid] < term):
            hi = mid
    return False

A  len(L)
*B log(len(L))
C len(L)*log(len(L))
D len(L)*len(L)
E None of the above
17. Order the following lines of code to create a program that reverses a string.

I. return myString
II. else:
III. if myString == "":
IV. return reverseR(myString[1:]) + myString[0]

A. III, IV, II, I
*B. III, I, II, IV
C. III, I, IV, II
D. II, I, III, IV
18. Given the following code:

```python
x = 0
for i in range(0,10):
    for j in range(0,10):
        for k in range(0,10):
            x = x + 1
print(x)
```

What is the value of x that will be printed?

A. 100
*B. 1000*
C. 10000
D. 10
E. 729
19. Recursion solves a problem by breaking it down into smaller and smaller sub problems of the same kind.

*A. True

B. False
20. Given the following code:

def myFunction(pic):

    for i in range(pic.getWidth()):
        for j in range(pic.getHeight()):
            # insert code here
            pic.setPixel(i,j,newColor)

Which of the following lines of code should be inserted to change the color of every pixel in the picture to white?

A. newColor = color_rgb(128,128,128)
B. newColor = color_rgb(216,18,199)
C. newColor = color_rgb(0,0,0)
*D. newColor = color_rgb(255,255,255)*
21. What are the key elements in recursion functions?

*A. recursive calls, termination condition
B. integers, floats, doubles
C. method, interface, class
D. none of the above
22. The following code is recursive. Which of the following lines are the termination condition and recursive call.

```python
def A(a):
    if a == 0:
        return 0
    a = a - 1
    a = A(a) + 1
    return a
```

A. line 6 is the recursive call and line 1 is the termination condition.

*B. line 5 is the recursive call and line 2 and 3 is the termination condition.

C. line 2 and 3 is the recursive call and line 5 is the termination condition.
23. True or false: given an array `A`, the following loops produce the same output.

| for a in A: | `i = 0` | for i in range(len(A)):
| print(a) | while(i < len(A)):
| | print(A[i])
| | i = i + 1
| print(A[i]) |

*A. True

B. False
24. How do you access element with value 2 from the following list: A = [[0,1,3], [[1,2],3],4]

A. A[2]
B. A[1][1]
C. A[1][1][1]
D. *A[1][0][1]
E. None of the above
25. What is the output for the following code?

def count():
    count = 0
    x = 987656789
    while(x > 0):
        if x % 10 > 7:
            x = x //10
            count = count + 1
        else:
            x = x //100
            count = count + 1
    print(count)

A. *6  
B. 7  
C. 8  
D. 9  
E. None of the above
26. What is the dominant color of the image after running the following code?

```python
for v in range(0, image.getHeight()):
    update()
for u in range(0, image.getWidth()):
    color = image.getPixel(u, v)
    image.setPixel(u, v, color_rgb(color[0], 0, 0))
    image.setPixel(u, v, color_rgb(0, color[1], 0))
    image.setPixel(u, v, color_rgb(0, 0, color[2]))
```

A. Red
B. *Blue
C. Green
D. Black
E. The image is not changed
27. What is the Python encoding of the following tree?

A. [20,3,32,23,19,5,1,3]
B. [20,1,2],[3,3,,-1],[32,4,,-1],[23,,-1,5],[19,6,7],[5,,-1,,-1],[1,,-1,,-1],[7,,-1,,-1]
C. (20,1,2),(3,3,,-1),(32,4,,-1),(23,,-1,5),(19,6,7),(5,,-1,,-1),(1,,-1,,-1),(7,,-1,,-1)
D. ((20,1,2),(3,3,,-1),(32,4,,-1),(23,,-1,5),(19,6,7),(5,,-1,,-1),(1,,-1,,-1),(7,,-1,,-1))
E. *[[20,1,2],[3,3,,-1],[32,4,,-1],[23,,-1,5],[19,6,7],[5,,-1,,-1],[1,,-1,,-1],[3,,-1,,-1]]