<table>
<thead>
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<th>QUESTION</th>
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<tr>
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<td>6</td>
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<td><strong>TOTAL</strong></td>
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25 Points – What is the value of each expression below? Answer any 25; answer more for extra credit. Variable $S = "SPRINGER SPANIEL", L = ["DOG", 6.9, 4], X = 7, T = (4.3, "RABBIT", 5), and $D = \{5:"S", 9:23.8, 1:"U"\}.

Answer “Error” if an expression cannot be computed for any reason. Incorrect answers will be assessed as -1, correct answers as +1, and blank answers as 0. Your score will be the total (but will not go below zero). For example, if you answer all 30 problems but get 25 right and 5 wrong, your final score will be 20. (-½ for missing quotes or type errors.)

1. $3 \text{ (int)} \quad X/2$
2. $8L \text{ (long)} \quad X + 1L$
3. $7.0 \text{ (float)} \quad X \times 1.0$
4. $13.9 \text{ (float)} \quad X + L[1]$
5. $30.8 \text{ (float)} \quad X + D[9]$
6. Error (int + tuple) $X + T$
7. $3 \text{ (int)} \quad \text{len}(L)$
8. $3 \text{ (int)} \quad \text{len}(L[0])$
9. Error (len(float)) $\text{len}(L[1])$
10. $3 \text{ (int)} \quad \text{len}(T)$
11. $6 \text{ (int)} \quad \text{len}(T) + \text{len}(L)$
12. $3 \text{ (int)} \quad \text{len}(D)$
13. Error (tuple + list) $T + L$
14. "DOG"RABBIT$ \quad L[0] + T[1]$
15. "L" $\quad S[-1]$
16. Error (out of range) $S[\text{len}(S)]$
17. " " (quoted blank) $S[8]$
18. "RUG" $\quad T[1][0] + D[1] + L[0][2]$
19. Error (no key = 2) $D[2]$
20. $4 \text{ (int)} \quad \text{int}(T[0])$
21. $23 \text{ (int)} \quad \text{int}(D[9])$
22. $4.0 \text{ (float)} \quad \text{round}(T[0])$
23. $24.0 \text{ (float)} \quad \text{round}(D[9])$
24. $4.0 \text{ (float)} \quad \text{round}(L[2])$
25. Error (round(string)) $\text{round}(T[1])$
26. $[1,9,25] \quad [I*I \text{ for } I \text{ in } \text{range}(1,7,2)]$
27. ["D","O","G"] $\quad [Q \text{ for } Q \text{ in } L[0]]$
28. $[0,1,2,3,4,5,6] \quad [Q \text{ for } Q \text{ in } \text{range}(X)]$
29. $[0,0,0] \quad [0 \text{ for } Z \text{ in } [5,2,8]]$
30. $[6,3,9] \quad [Z+1 \text{ for } Z \text{ in } [5,2,8]]$

5 Points – Based on the earlier variable definitions, which of the following expressions are legal, which are illegal, and why? (-1 per error, do not go below zero.)

$S[0] = "X" \quad L[0] = "X" \quad T[0] = "X"

Illegal (immutable) Legal (mutable) Illegal (immutable)
<3> 24 Points – What is printed out when `Main()` is called: (4 points each)

```
def FN(W,Q,X=2):
    print W+Q-X
    return

def Main():
    A = 4
    B = 7
    FN(A,B)

def F2(Q,Z,W=3):
    FN(2,B,A)
    FN(Z,Q)
    print W+Z
    return

FN(2,B,A)
F2(A,A)
F2(5,B,A)
```

Answers:

```
1. 9
2. 5
3. 6
4. 7
5. 10
6. 11
```

<4> 20 Points – Write code inside the `Weird` function below to swap randomly selected pairs of pixels a million times. That is, your code picks coordinates `<X1,Y1>` and `<X2,Y2>` randomly, then swaps the colors of the corresponding pixels. You may assume that the statement `import random` has already been executed earlier in the program. (2 points per line.)

```
def Weird(Canvas):
    for I in range(1000000):
        X1 = random.randrange(getWidth(Canvas))
        Y1 = random.randrange(getHeight(Canvas))
        X2 = random.randrange(getWidth(Canvas))
        Y2 = random.randrange(getHeight(Canvas))
        PX1 = getPixel(Canvas, X1, Y1)
        PX2 = getPixel(Canvas, X2, Y2)
        C1 = getColor(PX1)
        C2 = getColor(PX2)
        setColor(PX1, C2)
        setColor(PX2, C1)
        if ((I % 100) == 0): repaint(Canvas)
    return
```
16 Points – (½ point per slot.) A Whatzit is a yellow square of radius 50 (the radius of a square is from center-to-side, not center-to-corner), with a Blodge at each corner. A Blodge is a red circle of radius 30; with a Gronk 10 pixels diagonally away from its center in all four directions. Each Gronk is a green circle of radius 10 with a yellow square of radius 5 on top of it. Fill in the blanks below to complete the drawing of a Whatzit centered at location <X,Y> (shown with a dot). The addCircle and addSquare functions are already provided.

```python
def addCircle (Canvas, X, Y, Radius, NewColor=black): ...
def addSquare (Canvas, X, Y, Radius, NewColor=black): ...

def Whatzit (Canvas, X, Y):
    def Blodge (X, Y):
        def Gronk (X, Y):
            addCircle(Canvas, ___X, ___Y, ___10, green)
            addSquare(Canvas, ___X, ___Y, ___5, yellow)
            return
            addCircle(Canvas, ___X, ___Y, ___30, red)
        Gronk (X-10, Y-10) These four calls
        Gronk (X+10, Y-10) can be in
        Gronk (X-10, Y+10) any order.
        Gronk (X+10, Y+10)
        return
        addSquare(Canvas, ___X, ___Y, ___50, yellow)
    Blodge (X-50, Y-50) These four calls
    Blodge (X+50, Y-50) can be in
    Blodge (X-50, Y+50) any order.
    Blodge (X+50, Y+50)
    return
```

– Page 3 –
10 Points – Examine the Whatzit program on the previous page, and assume that all of the blanks have been filled in correctly to draw the indicated figure. Answer the following questions:

A. How many individual calls to addCircle and addSquare would be required if the Whatzit function was not designed as a hierarchical decomposition? (That is, Whatzit only contains calls to addCircle and addSquare, and does not define either Blodge or Gronk.)

Calls to addCircle: 20 (1 point)
Calls to addSquare: 17 (1 point)

B. Can Blodge be called from a function outside of Whatzit?

NO. (2 points) (Blodge is defined locally inside Whatzit.)

C. Can Gronk be called by Whatzit?

NO. (2 points) (Gronk is defined locally inside Blodge.)

D. Why don’t Blodge and Gronk need to be passed Canvas through their parameters?

Because Canvas is passed into Whatzit, and is locally “global” to Blodge and Gronk. (2 points)

E. Could Gronk be moved outside and above Blodge (but still remain inside Whatzit) and have everything still work?

YES. (2 points)