There are 40 multiple choice questions. Each one is worth 2.5 points.
Answer the questions on the bubble sheet given to you.
Only the answers on the bubble sheet will be counted.
The questions will be discarded.
Programmable calculators cannot be used.
This exam contains 29 pages (including this cover page)

Remember to fill in the following bubble card fields:

- Student ID: Use the 10 digit ID number on your student ID card. Do not use your social security number.
- Last Name and First Name
- Test/Quiz: 03, Course: 177
- Instructor: Your recitation TA’s last name. Find it in the table below:
- Section number: Your recitation section number. Find it in the table below:

<table>
<thead>
<tr>
<th>Recitation</th>
<th>Time</th>
<th>TA</th>
<th>Recitation Section Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>R01</td>
<td>Thursday, 07:30 am-08:20 am</td>
<td>Rohit Bhatia</td>
<td>0001</td>
</tr>
<tr>
<td>R02</td>
<td>Thursday, 09:30 am-10:20 am</td>
<td>Ruby Tahboub</td>
<td>0002</td>
</tr>
<tr>
<td>R03</td>
<td>Friday, 07:30 am-08:20 am</td>
<td>Ajay M S</td>
<td>0003</td>
</tr>
<tr>
<td>R04</td>
<td>Friday, 10:30 am-11:20 am</td>
<td>Haining Chen</td>
<td>0004</td>
</tr>
<tr>
<td>R05</td>
<td>Friday, 12:30 pm-01:20 pm</td>
<td>Rohit Bhatia</td>
<td>0005</td>
</tr>
<tr>
<td>R06</td>
<td>Friday, 02:30 pm-03:20 pm</td>
<td>Adib Rastegarnia</td>
<td>0006</td>
</tr>
<tr>
<td>R07</td>
<td>Friday, 04:30 pm-05:20 pm</td>
<td>Sait Celebi</td>
<td>0007</td>
</tr>
<tr>
<td>Y01</td>
<td>Distance learning</td>
<td>Wei Chuang</td>
<td>0008</td>
</tr>
</tbody>
</table>

Recitation Section Number:  
Student Last Name:  
Student First Name:  
1. Which of the following statements creates a 4x3 matrix full of 1's?
   A. matrix = 4*[1]*3
   B. [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
   C. matrix = [[1]*4 for i in range(3)]
   D. matrix = [1, 1, 1, 1]*3
   E. matrix = [[1]*3 for i in range(4)]

2. Which of the following options is true for the following Python program?

   ```python
   chr(ord('A')+2) == 'C'
   s = "Hello World!"
   n = s.find("o")
   print(n)
   s[n] = "z"
   print(s)
   ```

   A. It prints 46
      HellzWzrld
   B. It prints 4
      HellzWzrld
   C. It prints 4
      HellzWorld
   D. It prints 6
      HelloWzrld
   E. Has TypeError
3. What is the output of the following Python program?

```python
l1 = [1, 2, 2, 3, 3, 3, 4, 4, 4, 4] * 4
l1 = l1[0:15]

l2 = [l1.count(1), l1.count(2), l1.count(3), l1.count(4)]

print(l2)
```

A. [0, 0, 0, 0]  
B. [2, 3, 4, 4]  
C. [2, 3, 4, 5]  
D. [2, 4, 5, 4]  
E. [2, 4, 5, 8]

4. What is the output of the following Python program?

```python
myList = list(range(8)) + list(range(2, 4)) + list(range(4, 8))

myList = myList[2:-2]
myList = myList[3:-3]

myList.reverse()

print(myList)
```

A. [2, 7, 6, 5]  
B. [5, 2, 8, 4]  
C. [3, 2, 4, 9]  
D. [1, 2, 3, 4, 5]  
E. [2, 7, 6, 5, 8]
5. Which of the following programs use recursion?

I. 
```python
def addListElements(list):
    if len(list)==0:
        return 0
    return list[0]+addListElements(list[1:])
```

II. 
```python
def addListElements(list):
    count=0
    for elem in list:
        count+=elem
    return count
```

III. 
```python
def fibonacci(n):
    if (n==1 or n==2):
        return 1
    return fibonacci(n-1)+fibonacci(n-2)
```

IV. 
```python
def fibonacci(n):
    fibs = [0,1,1]
    for i in range(2,n):
        fibs.append(fibs[i]+fibs[i-1])
    return fibs[n]
```

A. I
B. I, II and III
C. I and IV
D. I and III
E. I and III and IV
6. What is the output of the following Python program?

```python
def Collatz(n):
    v = []
    while n > 1:
        if n % 2 == 0:
            n = int(n / 2)
        else:
            n = n * 3 + 1
        v.append(n)
    print(len(v))

Collatz(5)
```

A. 3
B. 4
C. 5
D. 6
E. The code has an infinite loop

7. What is the time complexity of linear search and binary search, respectively?

A. O(n), O(n)
B. O(n), O(1)
C. O(1), O(log(n))
D. O(n), O(log(n))
E. O(log(n)), O(log(n))
8. What is the output of the following program

```python
def lucasNumbers(n):
    if (n==0):
        return 2
    if (n==1):
        return 1
    return lucasNumbers(n-1) + lucasNumbers(n-2)

print(lucasNumbers(5))
```

A. 5  
B. 7  
C. 8  
D. 11  
E. 18

9. What is the space complexity of this algorithm that reverses a List (input is a list of length n)

```python
def reverse(list1):
    newlist = []
    for i in range(-1,-len(list1)-1,-1):
        newlist.append(list1[i])
    return newlist
```

A. O(1)  
B. O(log(n))  
C. O(n)  
D. O(n*log(n))  
E. O(n²)
10. ....................... is a variable that is shared by all instances of a class?
   A. Object Variable
   **B. Class Variable**
   C. Data Variable
   D. Instance Variable
   E. None of the Above

11. Which of the following provides a single interface to entities of different types?
   A. Encapsulation
   B. Inheritance
   C. Multiple Inheritance
   **D. Polymorphism**
   E. Instantiation

12. What is the output of the following Python program?
    ```python
    s = "04/16/2015"
    d = s.split("/")
    print(s2)
    ```
    A. 16/04/2015
    B. 04/16/2015
    C. 2015/04/16
    D. 2015/16/04
    E. 16/2015/04
13. Which of the following Python features is/are used in the following code?

```python
class B:
    def __init__(self):
        self.i = 0

    def seti(self, x):
        self.i = x

    def geti(self):
        return self.i

    def p(self):
        return "From B"

class D(B):
    def __init__(self):
        B.__init__(self)
        self.j = 0

    def setj(self, y):
        self.j = y

    def getj(self):
        return self.j

    def p(self):
        return "From D"
```

A. Encapsulation
B. Inheritance
C. Polymorphism
D. Inheritance and Polymorphism
E. Encapsulation, Inheritance and Polymorphism
14. What is the output of the following Python program?

```python
class A:
    def __init__(self, i):
        self.i = i

    def m1(self):
        self.i += 1

class B(A):
    def __init__(self, j):
        A.__init__(self, 3)
        self.j = j

    def m1(self):
        A.m1(self)
        self.j += 1

def main():
    b = B(0)
    b.m1()
    print(b.i, b.j)

main()
```

A. 0 0  
B. 4 1  
C. 3 1  
D. 3 0  
E. Error
15. What is the output of the following Python program?

```python
class B:
    def __init__(self, name):
        self.name = name

    def get(self):
        return "Person’s get is called"

    def printB(self):
        print(self.get())

class D(B):
    def get(self):
        return "Student’s get is called"

def main():
    b = B("p1")
    d = D("s1")
    b.printB()
    d.printB()

main()
```

A. Person’s get is called
   Person’s get is called

B. Person’s get is called
   Student’s get is called

C. Student’s get is called
   Person’s get is called

D. Student’s get is called
   Student’s get is called

E. Error
16. ....................... is a variable that is defined inside a method and belongs only to a current instance of a class?
   A. Private Variable
   B. Class Variable
   C. Data Variable
   D. Instance Variable
   E. None of the Above

17. What is the output of the following Python program if user enters 3?

```python
num = input(“Please input a number”)
n2 = int(num)
y = num * 3
z = n2 * 5
print(y, z)
```

A. 333 33333
B. 9 15
C. 9 33333
D. 333 15
E. 3 * 3 15
18. What is the output of the following Python program?

```python
x = ord('A') + 2
print(x)
```

A. A2
B. C
C. 67
D. TypeError
E. AA

19. What is the output of the following Python program?

```python
def func(a):
    b = a[:]
    b[0] = 0
    c = a
    c[2] = 4
    print(b)

a = [1, 2, 3]
func(a)
print(a)
```

A. [0, 2, 3]
   [1, 2, 3]
B. [0, 2, 4]
   [1, 2, 3]
C. [0, 2, 3]
   [1, 2, 4]
D. [0, 2, 3]
   [0, 2, 3]
E. [0, 2, 4]
   [0, 2, 4]
20. What is the output of the following Python program?

```python
x = [1, 2, 3]
y = x * 2
z = y + x
print(z)
```

A. 18  
B. [3, 6, 9]  
C. [2, 4, 6, 1, 2, 3]  
D. [1, 2, 3, 1, 2, 3, 1, 2, 3]  
E. [1, 2, 3, 1, 2, 3, 1, 2, 3]

21. What is the output of the following Python program?

```python
s = " abcdef"
s2 = s[1:8:3] + s[:2] + s[5:]
print(s2)
```

A. adaef  
B. babf  
C. becdefabcde  
D. beaceef  
E. beabf
22. Given the contents of the file `cities.txt`:

Tokyo
Moscow
Lagos
London

What would the file `output.txt` be after the following Python program is executed?

```python
f = open("cities.txt", "r")
f2 = open("output.txt", "w")
for i in range(4):
    line = f.readline()
    print(line[:-1], file=f2)
```

A. Tokyo
   Moscow
   Lagos
   London

B. Tokyo Moscow Lagos London

C. Tokyo Moscow Lagos London

D. The file is empty

E. Tokyo
   Moscow
   Lagos
   London
23. What is the output of the following Python program?

```python
def func():
    A = [[15]*5 for i in range(9)]
    B = [['Burger']*2 for i in range(len(A)*2)]
    C = [['IceCream']*3 for i in range(len(A)+len(B))]
    print(len(A) + len(B) + len(C))
func()
```

A. 54  
B. 90  
C. 180 
D. 675 
E. None of the above

24. What is the output of the following Python program?

```python
def updateList(list):
    for i in range(len(list)-1, -1, -1):
        if list[i] > 5:
            list.pop(i)

def func():
    A = [1, 20, 4, 5, 12, 12, 25, 2, 90]
    updateList(A)
    print(A)
func()
```

A. [1, 4, 2]  
B. [1, 4, 5, 2] 
C. [1, 4, 5, 12, 2] 
D. [1, 20, 4, 5, 12, 12, 25, 2, 90] 
E. Error
25. What is the output of the following Python program?

```python
def func(A, B, C):
    D = []
    for item in A:
        if item in B:
            D.append(item)
    E = []
    for item in C:
        if item in D:
            continue
        E.append(item)
    return E

A = [1, 3, 2, 7, 10, 4, 3]
B = [2, 3, 5, 7, 18, 20]
C = [7, 99, 22, 5, 3]
result = func(A, B, C)
print(result)
```

A. [3, 2, 7, 3]
B. [1, 10, 4]
C. [5, 18, 20]
D. [7, 99, 22, 5, 3]
E. [99, 22, 5]

26. What is the output of the following Python program?

```python
a = True
b = False
c = True
x = (a or b) and not (a and b)
y = (a and (not c)) or ((not a) and c)
print(x, y)
```

A. False False
B. False True
C. True False
D. True True
E. None of the above
27. What is the output of the following Python program?

```python
def func(a, b, c):
    if a > b and c < a:
        return a
    elif a <= b and c >= a:
        return 2*a
    elif a > b:
        return c
    elif c < a:
        return b

print(func(4, 5, 3))
```

A. 3
B. 4
C. 5
D. 8
E. 10

28. What is the output of the following Python program?

```python
def func(n):
    A = [[20, [30, 40], 50], ['w', 'x', 'y', 'z'], [3, 4], 1, 'end'], ['I', 'Love', 'Purdue', ['Oh', 'YEAH']]]

for item in A:
    if len(item) == n:
        for x in item:
            print(x, end=" ")

func(4)
```

A. 20 [30, 40] 50 w x y z [3, 4] 1 end
B. 20 [30, 40] 50 w x y z I Love Purdue ['Oh', 'YEAH']
C. w x y z [3, 4] 1 end
D. w x y z [3, 4] 1 end I Love Purdue ['Oh', 'YEAH']
E. w x y z I Love Purdue ['Oh', 'YEAH']
29. What is the output of the following Python program?

```python
myList1 = list(range(6)) * 2
myList2 = list(range(5,8)) * 2
mySet = set(myList1) - set(myList2)
print(mySet)
```

A. \{0, 1, 2, 3, 4\}
B. \{1, 2, 3, 4\}
C. \{0, 2, 4, 6\}
D. [0, 2, 5, 7]
E. [0, 2, 6, 8]

30. What is the output of the following Python program?

```python
myDict1 = {}
myDict2 = {}
for i in range(10):
    myDict1[i] = i*3 + 2
    myDict2[i] = i*4 - 1

temp = 0
for j in range(4,7):
    temp += myDict1[j] + myDict2[j]

print(temp)
```

A. 62
B. 80
C. 104
D. 108
E. 120
31. What is the output of the following Python program?

```python
def isPrime(x):
    for i in range(2, x):
        if x % i == 0:
            return False
    return True

temp = 0
for i in range(2, 8):
    if i % 3 == 0:
        temp += i ** 2
    elif isPrime(i):
        temp += i * 2
    else:
        temp += i

print(temp)
```

A. 61  
B. 66  
C. 77  
D. 79  
E. 82

32. Which of the following is correct about Project-4 (K-Nearest-Neighbor Classifier Project)?

A. We have written all the program into one .py file and did not use any import statement.

B. We followed an Object Oriented Programming approach to solve the problem.

C. k = 0 is a valid input

D. If we have 5 blue points and 100 red points in the training set and use k=11, all new points will be classified as red.

E. If we have 6 blue points and 100 red points in the training set and use k=11, all new points will be classified as red.
33. What is the output of the following Python program? (Project-2, Caesar Cipher Project)

```python
    temp = "PURDUE"
    result1 = caesarEncipher(temp, 5)
    result2 = caesarDecipher(result1, 5)
    print(temp)
    print(result1)
    print(result2)
```

A. UZWIZJ
   PURDUE
   UZWIZJ

B. PURDUE
   UKZIWJ
   PURDUE

C. PURDUE
   UZWIZJ
   PURDUE

D. PURDUE
   UZKSJI
   KUJKMI

E. PURDUE
   MUKZJI
   BESIKT

34. We store the fruits and the names of people who ate fruits in the following list format: 
\[
[[\text{name}_1, \text{fruit}_1], [\text{name}_2, \text{fruit}_2], \ldots, [\text{name}_N, \text{fruit}_N]]
\]
This means \text{name}_1 ate \text{fruit}_1, \text{name}_2 ate \text{fruit}_2, etc.. How to find the names of people who ate more than one different fruit?

\[
\text{myList} = [
[\text{'Sait', 'Apple'}],
[\text{'Ruby', 'Strawberry'}],
[\text{'Matthew', 'Banana'}],
[\text{'Adib', 'Orange'}],
[\text{'Sait', 'Peach'}],
[\text{'Steve', 'Cranberry'}],
[\text{'Matthew', 'Kiwi'}],
[\text{'Steve', 'Cranberry'}]
]
\]

Qualifying names should be: Sait and Matthew (Order is not important in the result.)

A. \[
\text{temp} = []
\text{for item in myList:}
\text{temp.append(item[1])}
\text{if temp.count(item[1]) == 2:}
\text{print(item[0])}
\]

B. \[
\text{temp} = []
\text{for item in myList:}
\text{temp.append(item[0])}
\text{if temp.count(item[0]) == 2:}
\text{print(item[0])}
\]

C. \[
\text{temp} = \text{set()}
\text{for item in myList:}
\text{temp.add(item[0])}
\text{if item[1] in temp:}
\text{print(item[0])}
\]

D. \[
\text{temp} = {}
\text{for item in myList:}
\text{if item[0] not in temp:}
\text{temp[item[0]] = set()}
\text{temp[item[0]].add(item[1])}
\text{if len(temp[item[0]]) == 2:}
\text{print(item[0])}
\]

E. \[
\text{temp} = {}
\text{for item in myList:}
\text{if item[0] not in temp:}
\text{temp[item[0]] = set()}
\text{temp[item[0]].add(item[1])}
\]
if \ \text{len}(\text{temp}[\text{item}[1]]) == 2:
    \text{print}(\text{item}[1])

35. Consider the following Python program:

```python
from graphics import *
def main():
    win = GraphWin('My window', 300, 300)
    text = ?
    text2 = ?
    text2.setSize(15)
    text.setSize(15)
    text.draw(win)
    text2.draw(win)
main()
```

What should be at ?, text, text2 in order to get the following output?
A. \[\text{win.setCoords}(0,0,300,300)\]
\[
\text{text} = \text{Text}(\text{Point}(50, 50), \ 'Purdue')
\text{text2} = \text{Text}(\text{Point}(130, 50), \ 'University')
\]

B. \[\text{win.setCoords}(300,300,0,0)\]
\[
\text{text} = \text{Text}(\text{Point}(50, 50), \ 'Purdue')
\text{text2} = \text{Text}(\text{Point}(130, 50), \ 'University')
\]

C. \[\text{win.setCoords}(300,300,0,0)\]
\[
\text{text} = \text{Text}(\text{Point}(50, 50), \ 'Purdue')
\text{text2} = \text{Text}(\text{Point}(50, 130), \ 'University')
\]

D. \[\text{win.setCoords}(0,0,300,300)\]
\[
\text{text} = \text{Text}(\text{Point}(50, 50), \ 'Purdue')
\text{text2} = \text{Text}(\text{Point}(50, 130), \ 'University')
\]

E. \[\text{win.setCoords}(0,0,300,300)\]
\[
\text{text} = \text{Text}(\text{Point}(130, 50), \ 'Purdue')
\text{text2} = \text{Text}(\text{Point}(50, 50), \ 'University')
\]
36. Consider the following Python program:

```python
from graphics import *
def main():
    win = GraphWin('My Window', 300, 300)
    win.setCoords(0, 0, 300, 300)
    for i in range(50, 100, 10):
        ?
        cir.draw(win)
    win.getMouse()

main()
```

What should be at ? in order to get the following output?

A. `cir = Circle(Point(150, 150), i)`
B. `cir = Circle(Point(50, 50), i)`
C. `cir = Circle(Point(250, 250), i)`
D. `cir = Circle(Point(0, 0), i)`
E. `cir = Circle(Point(300, 0), i)`
37. What is the output of the following Python program?

```python
from graphics import *
def main():
    win = GraphWin('My Window', 300, 300)
    win.setCoords(0, 0, 300, 300)
    line = Line(Point(50, 100), Point(150, 200))
    x = line.getP1().getX()
    y = line.getP2().getY()
    print(x, y)
    win.getMouse()

main()
```

A. 50 100
B. 50 200
C. 50 150
D. 150 200
E. 100 150

38. What is the output of the following Python program?

```python
from graphics import *
def main():
    win = GraphWin('My Window', 300, 300)
    win.setCoords(0, 0, 300, 300)
    rect = Rectangle(Point(50, 100), Point(150, 200))
    x = rect.getX()
    y = rect.getY()
    print(x, y)
    win.getMouse()

main()
```

A. 50 100
B. 50 200
C. 50 150
D. 150 200
E. AttributeError: 'Rectangle' object has no attribute 'getX'
39. Consider the following Python program:

```python
from graphics import *

def main():
    win = GraphWin('My Window', 300, 300)
    win.setCoords(0, 0, 300, 300)
    rect = Rectangle(Point(100,100), Point(200,200))
    x1 = rect.getP1().getX()
    y1 = rect.getP1().getY()
    x2 = rect.getP2().getX()
    y2 = rect.getP2().getY()
    line1 = ?
    line2 = ?
    rect.draw(win)
    line1.draw(win)
    line2.draw(win)
    win.getMouse()

main()
```

What should be at `line1` and `line2` in order to get the following output?
A. \[ \text{line1} = \text{Line(} \text{Point}(x_1,y_1), \text{Point}(x_2,y_2) \text{)} \]
\[ \text{line2} = \text{Line(} \text{Point}(x_1 + 100,y_1), \text{Point}(x_1 + 100,y_1) \text{)} \]

B. \[ \text{line1} = \text{Line(} \text{Point}(x_1,y_1), \text{Point}(x_2,y_2) \text{)} \]
\[ \text{line2} = \text{Line(} \text{Point}(x_1,y_1 + 100), \text{Point}(x_1 + 100,y_1) \text{)} \]

C. \[ \text{line1} = \text{Line(} \text{Point}(x_1,y_1), \text{Point}(x_2,y_2) \text{)} \]
\[ \text{line2} = \text{Line(} \text{Point}(x_1 + 100,y_1), \text{Point}(x_2 + 100,y_2) \text{)} \]

D. \[ \text{line1} = \text{Line(} \text{Point}(x_1,y_1), \text{Point}(x_2,y_2) \text{)} \]
\[ \text{line2} = \text{Line(} \text{Point}(x_1 + 100,y_1), \text{Point}(x_2,y_2 + 100) \text{)} \]

E. \[ \text{line1} = \text{Line(} \text{Point}(x_1,y_1), \text{Point}(x_2,y_2) \text{)} \]
\[ \text{line2} = \text{Line(} \text{Point}(x_2,y_2 + 100), \text{Point}(x_1 + 100,y_1) \text{)} \]
40. What is the output of the following Python program?

```python
from graphics import *

def main():
    win = GraphWin('My Window', 400, 400)
    win.setCoords(0, 0, 300, 300)
    rect = Rectangle(Point(100, 100), Point(200, 200))
    x1 = rect.getP1().getX()
    y1 = rect.getP1().GetY()
    cir = Circle(Point(x1, y1), 100)
    rect.draw(win)
    cir.draw(win)
    win.getMouse()

main()
```