1. Fill in your information:

   Full Name: ____________________________
   UIN (Student Number): ____________________________
   NetID: ____________________________

A. This test is fairly representative of the contents of the second midterm.
B. Material from lectures through lec21 will be included.
C. We will also test random distributions (uniform v. normal.)

2. Fill in the following answers on the Scantron form:

   95. D
   96. C
1. (1 point) Consider the following program.

```python
a=[1,"2","3",0]
x="" 
for e in a:
    try:
        x+=int(e)
    except:
        x+="A"
```

After it is run, what is the final value of x?

(A) 'AAAA'

(B) 'A23A'

(C) '23'

(D) None of the other answers are correct.

(E) '1AA0'

Solution.
2. (1 point) Consider the following program.

```python
x=[]
for j in range(0,6):
    if (j%4)==0:
        x.append("-")
    if (j%3)==0:
        x.append("*")
```

After it is run, what is the final value of x?

(A) ★

`["-","*","*","-"]`

(B) None of the other answers are correct.

(C) `["*","-","*"]`

(D) `["-","*"]`

(E) `["*","-","*"]`

Solution.
3. (1 point) For this problem, your job is to put the lines of code below in the proper order to create a function that accomplishes a task. We will completely ignore indentation.

```python
1 def is_close( a,b,atol )
2 atol = 1e-3
3 return ( abs(a-b) <= atol )
4 return ( (a-b) <= atol )
5 except:
6 def is_close( a,b,atol=1e-3 ):
7 try:
8 return None
```

The function you should write is called `is_close`, and it should accept two numbers, `a` and `b`. An optional third argument is the relative tolerance `atol` with default value `1e-3`. `is_close` returns `True` or `False` depending on whether the numbers are closer than `atol`:

\[
|a - b| \leq atol \rightarrow True \quad \quad |a - b| > atol \rightarrow False
\]

The code should return `None` if the calculation fails (for instance, if the parameters `a` or `b` are non-numeric).

What is the proper selection and ordering of the given lines of code?

(A) ★ 6, 7, 3, 5, 8
(B) 1, 2, 7, 3, 5, 8
(C) 6, 7, 4, 5, 8
(D) 6, 3
(E) 1, 2, 7, 4, 5, 8

Solution.
4. (1 point) Consider the following program.

```
x=0
# x+=1  # x+=1
    
    
x+=1
    
    
x+=1
    
    
x+=1
```

After it is run, what is the final value of x?

(A) 4
(B) 3
(C) 1
(D) 5
(E) ★

2

Solution.
5. (1 point) Consider the following 2-dimensional numpy array:

\[
\begin{bmatrix}
1 & 5 & 9 \\
2 & 6 & 10 \\
3 & 7 & 11 \\
4 & 8 & 12
\end{bmatrix}
\]

Assuming it is stored in a variable named a, how can we index and retrieve the value 7?

(A) \( a[3][2] \)

(B) \( a[1][2] \)

(C) \( a[2][3] \)

(D) \( \star \ a[2][1] \)

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Solution.
6. (1 point) Consider the following program.

def f(x):
    for i in range(x):
        return x+1
    return 100

x=f(5)

After it is run, what is the final value of x?

(A) 6

(B) ★ None of the other answers are correct.

(C) 100

(D) 3

(E) 5

Solution.
7. (1 point) Consider the following program.

```python
a, b = "OBI", "WAN"
def f(a):
    return tuple(a)
a, b = b, a
x = 

, 
.join(f(b))
```

After it is run, what is the final value of `x`?

(A) "W, A, N"
(B) "W", "A", "N"
(C) None of the other answers are correct
(D) ★
    "O, B, I"
(E) "O", "B", "I"

Solution.
8. (1 point) Which of the following Python programs best simulates the roll of one six-sided die in the variable x? (I.e., any number from 1–6 inclusive is equally likely to result from the die roll or program code.)

(A) \( x = \text{np.random.uniform}( \text{np.arange}(1,7) ) \)

(B) \( x = \text{np.random.randn}( \text{np.arange}(1,7) ) \)

(C) \( x = \text{np.random.shuffle}( \text{np.arange}(1,7) ) \)

(D) ★

\[ x = \text{np.random.choice}( \text{np.arange}(1,7) ) \]

Solution.
9. (1 point) Consider the following program.

def f(x):
    if x<10:
        print(x)
    else:
        print(x+1)
x=f(5)

After it is run, what is the final value of x?

(A) 6
(B) 4
(C) 10
(D) ★ None of the other answers are correct.
(E) 5

Solution.
10. (1 point) Consider the following program.

```python
a=[1,"2", "3", 0]
x=""
for e in a:
    try:
        x+=e
    except:
        x+="A"
```

After it is run, what is the final value of `x`?

(A) None of the other answers are correct.

(B) ⭐

'"A23A"'

(C) '23'

(D) 'AAAA'

(E) '1AA0'

Solution.
11. (1 point) Consider the following exception.

**TypeError**: can only concatenate tuple (not "int") to tuple

Which of the following programs will throw this exception?

(A) "LAN"+[tuple("DO")]

(B) ★

   tuple("LAN")+len("DO")

(C) tuple("LAN")[len("DO")]

(D) None of the other answers are correct

(E) tuple("LAN")+tuple("DO")

Solution.
def chase( chevy ):
    chevy.append( "arrow" )
    chevy.reverse()
    chevy = chevy.sort()
    return chevy

earl = "cheviot hills".split(" ")
chase( earl )

After it is run, what is the final value of earl?

(A) ['hills', 'cheviot', 'arrow']
(B) ★ ['arrow', 'cheviot', 'hills']
(C) ['hills', 'cheviot']
(D) None
(E) ['cheviot', 'hills', 'arrow']

Solution.
13. (1 point) Consider the following program:

```python
a=1
def f():
    return 1
a=3
x=a+f()
```

What is the value of x after this program is executed?

(A) 3
(B) None of the other answers are correct.
(C) 1
(D) ★ 2
(E) 4

Solution.
14. (1 point) Consider the following program.

```python
e=[1,2,3,4,5]
d={0:0,1:0}
for a,b in enumerate(e):
    d[b%2]+=a
x=d[1]
```

After it is run, what is the final value of x?

(A) 3  
(B) 15  
(C) 9  
(D) 4  
(E) ⭐  

6

Solution.
15. (1 point) Consider the following program.

```python
import numpy as np
x=np.zeros((3,3))
for i in range(3):
    x[i][i]=1
    for j in range(3):
        if i>=j:
            continue
        x[i][j]=2
```

After it is run, what is the final value of `x`?

(A) $\begin{bmatrix} 1 & 2 & 2 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 2 & 2 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & 2 & 2 \\ 0 & 2 & 2 \\ 0 & 0 & 2 \end{bmatrix}$

(E) $\begin{bmatrix} 2 & 0 & 0 \\ 2 & 2 & 0 \\ 2 & 2 & 2 \end{bmatrix}$

Solution.
16. (1 point) Consider the following program:

```python
d={}  
for i, c in enumerate("ABCDEFGHIJKLMNOPQRSTUVWXYZ"):  
    d[c]=i  
x=0  
for c in "HANSOLO":  
    x+=d[c]
```

What is the value of $x$ after this program is executed?

(A) 84  
(B) 62  
(C) None of the other answers are correct.  
(D) ⋆  

77  
(E) 93

Solution.
17. (1 point) What should replace the three question marks to produce a program that runs without throwing an exception? Note: \texttt{sin}, \texttt{cos}, and \texttt{pi} are all part of the \texttt{math} module.

\[
???
\text{math.sin(pi)}+\text{math.cos(pi)}
\]

(A) \texttt{import math as pi, as sin, as cos}

(B) \texttt{from math import *}
   \hspace{1cm} \text{import sin,cos}

(C) \texttt{from math import sin,cos}
   \hspace{1cm} \text{import math}

(D) ☀
   \hspace{1cm} \text{import math}
   \hspace{1cm} \text{from math import pi}

Solution.
18. (1 point) Consider the following program.

```python
x="5 4 1".split()
x=x.sort()
try:
    print(len(x))
except:
    print(type(x))
```

After it is run, what is printed by this program?

(A) list
(B) ⋆
   NoneType
(C) 3
(D) TypeError

Solution.
19. (1 point) Consider the following program.

```python
import numpy as np
x = np.array([1, 2] + [3, 4]) + 5
```

After it is run, what is the final value of `x`?

(A) `[9 11]`

(B) None of the other answers are correct

(C) `[9 11]`

(D) `[6 7]

(E) ⋆ `[6 7 8 9]`

Solution.
20. (1 point) Consider the following exception.

ValueError: invalid literal for int() with base 10: "R"

Which of the following programs will throw this exception?

(A) "RAN"[10]"COR"

(B) None of the other answers are correct

(C) ★

    int("RANCOR"[0])

(D) 10+"RANCOR"

(E) "RANCOR"[int("10")]

---

Solution.
21. (1 point) Consider the following program.

```python
a = list("JEDI")
for c in "EDJI":
    print(a[c])
```

What kind of exception will this program throw?

(A) `KeyError: 'E'

(B) `TypeError: cannot concatenate 'str' and 'int' objects`

(C) None of the other answers are correct

(D) ⋆`TypeError: list indices must be integers, not str`

(E) `SyntaxError: invalid syntax`

Solution.
22. (1 point) Consider the following incomplete function.

```python
def pal(s):
    a = list(s)
    n = len(s)

???
```

The function is intended to return True if and only if the input string s is a palindrome. A palindrome is a string that reads the same forward and backward, like “ABBA” or “RACECAR”. What should replace the three question marks to complete the function?

(A) return a[0:n:-1]==a[n:0:1]

(B) ⋆

```python
for i in range(n):
    if a[i]!=a[n-i-1]:
        return False
return True
```

(C) return a[:n//2]==a[(n+1)//2:]

(D) return a==a.reverse()

(E) None of the other answers are correct.

Solution.
23. (1 point) Consider the following incomplete Python program:

```python
def tribo( n ):
    if n <= 1:
        return 1
    else:
        ???
```

The function `tribo` should return the $n$th number of the so-called “Tribonacci” sequence (counting from zero), in which each number is equal to the sum of the preceding three; i.e.,

$$0, 0, 1, 1, 2, 4, 7, 13, 24, 44, 81, ...$$

What should replace the `??` block to complete the program correctly?

(A) ★ `return tribo( n-1 ) + tribo( n-2 ) + tribo( n-3 )`

(B) `return (n - 1) + (n - 2) + (n - 3)`

(C) `return tribo[ n-1 ] + tribo[ n-2 ] + tribo[ n-3 ]`

(D) `return tribo( n-1, n-2, n-3 )`

(E) `return tribo( n ) + tribo( n-1 ) + tribo( n-2 )`

Solution.
24. (1 point) Consider the following program.

```python
import numpy as np
x=np.zeros((3,3))
for i in range(3):
    for j in range(3):
        x[i][j]=i*j+i
```

After it is run, what is the final value of x?

(A) \[
\begin{bmatrix}
0 & 1 & 2 \\
0 & 2 & 4 \\
0 & 3 & 6 \\
\end{bmatrix}
\]

(B) None of the other answers are correct

(C) \[
\begin{bmatrix}
0 & 0 & 0 \\
1 & 2 & 3 \\
2 & 4 & 6 \\
\end{bmatrix}
\]

(D) \[
\begin{bmatrix}
0 & 1 & 2 \\
1 & 2 & 3 \\
4 & 5 & 6 \\
\end{bmatrix}
\]

(E) \[
\begin{bmatrix}
0 & 1 & 4 \\
1 & 2 & 5 \\
2 & 3 & 6 \\
\end{bmatrix}
\]

Solution.
25. (1 point) Consider the following Python program.

```python
e=list(range(6,-1,-1))
d={0:1,1:2,2:3,3:4}
for i in e:
    d[i%3]+=e[i]

x=d[1]
```

After it is run, what is the final value of `x`?

(A) ⭐

9

(B) 16

(C) 5

(D) 3

(E) 12

---

Solution.
26. (1 point) Evaluate the following expression:

len("4,5,6,7".split(','))

(A) 6

(B) "4567"

(C) 22

(D) ⋆

      5

(E) 4

Solution.
27. (1 point) Consider the following program:

```python
d={}  
for i, c in enumerate("ABCDEFGHIJKLMNOPQRSTUVWXYZ"):  
    d[c]=i  
x=0  
for c in "CHEWBACCA":  
    x+=d[c]
```

What is the value of x after this program is executed?

(A) 35
(B) 44
(C) 40
(D) None of the other answers are correct.
(E) ⋆

77

Solution.
28. (1 point) Consider the following program.

```python
import numpy as np
x=np.zeros((3,3))
for i in range(3):
    for j in range(3):
        x[i][j]=i*j+j
```

After it is run, what is the final value of `x`?

(A) $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$

(B) $\begin{bmatrix} 0 & 1 & 2 \\ 0 & 2 & 4 \\ 0 & 3 & 6 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 0 & 0 \\ 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix}$

(D) $\begin{bmatrix} 0 & 1 & 4 \\ 1 & 2 & 5 \\ 2 & 3 & 6 \end{bmatrix}$

(E) None of the other answers are correct

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**Solution.**