

Quantitative Proficiency Test

Question 1

Given:

```
import pandas as pd
import numpy as np
data = {'Ticker': ['IBM', 'AAPL'], 'Price':
```

which of the following creates a data frame?

- df = pd.DataFrame(data)
- df = (pd.DataFrame) data
- df = np.DataFrame(data)
- df = (np.DataFrame) data

 Time left:
24:25

QUESTIONS

| | | | | |
|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 |
| 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 |
| 56 | 57 | 58 | 59 | 60 |

Question 2

Consider the following statements concerning a positive integer n :

1. if n is a multiple of 4, then n^2 is a multiple of 2
2. if n^2 is a multiple of 5, then n is a multiple of 5
3. if n^2 is a multiple of 10, then n is a multiple of 5

Which of the statements is true?

- All of the statements
- Statements 1 and 3
- None of the statements
- Statements 2 and 3

Question 3

What type of copy command is used in the program below?

```
a=[[3,4,5],[6,7,19],[8,15,17]]
b=list(a)
```

- Deep copy
- Hollow copy
- Cannot be determined
- Shallow copy

Question 4

Simplify:

$$\sin^2 x + \cos^2 x =$$

- 1
- $\tan^2 x$
- None of these
- $2 \sin(x) \cos(x)$

Question 5

For the equation:

$$xy^2 - 2xy + x^2y = 12$$

what is the slope of the tangent line at $(x, y) = (1, 4)$

- 16/7
 -22/7
 -16/11
 -22/11

Question 6 Which of the following expressions does not have an integral which can be expressed in terms of elementary functions ($1, x, \ln(x), \sin(x)$, etc.)

- $\frac{1}{e^x}$
 e^{x^2}
 $\sin(x)e^x$
 $\frac{1}{x^2+1}$

Question 7 Express as summation:

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64}$$

- $\sum_{n=0}^6 2^n$
 $\sum_{n=1}^6 2^n$
 $\sum_{n=1}^6 2^{-n}$
 $\sum_{n=0}^6 2^{-n}$

Question 8 The Pearson correlation coefficient between 2 variables is:

- Close to 1 if they tend to move in the same direction.
 Close to 0 if they move independently of each other.
 All of these
 Close to -1 if they tend to move in the opposite direction.

Question 9

Given the function:

$$f(x, y) = x + y$$

with the constraint that $x^2 + y^2 = 1$, at which points do the maximum and minimum of $f(x, y)$ occur?

- $(\sqrt{2}, \sqrt{2})$ and $(-\sqrt{2}, -\sqrt{2})$
 $(\frac{2}{\sqrt{2}}, \frac{2}{\sqrt{2}})$ and $(-\frac{2}{\sqrt{2}}, -\frac{2}{\sqrt{2}})$
 $(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$ and $(-\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}})$
 $(\frac{1}{2}, \frac{1}{2})$ and $(-\frac{1}{2}, -\frac{1}{2})$

Question 10

The value of the limit

$$\lim_{x \rightarrow \infty} \frac{2-x^3}{x^2+3x^3}$$

is:

- ∞
 $-1/3$
 1
 0

Question 11

Find x:

$$4^{\log_4(x/10)} = 16$$

- 40
- 160
- 1.6
- 120

Question 12

Evaluate:

$$\int \ln(2x) dx$$

- $2 \ln(2x) + C$
- $x \ln(2x) - x + C$
- $\frac{\ln(2x-1)}{2} + C$
- $\frac{\ln(2x)}{2} + C$

Question 13

Let $x_0 \in \mathbb{R}$ be the value of $x \in \mathbb{R}$ that maximizes the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by

$$f(x) = e^{-(x^2+1)}$$

and $y_0 = f(x_0)$ be the value of this maximum.

Then $x_0 + y_0$ is:

- $2e^{-1}$
- 2
- e^{-1}
- 1

Question 14

Find x:

$$x^3 = -8$$

- 2
- (-2, 2)
- $\frac{1}{2}$
- 2

Question 15

$$1 + x + x^2 + x^3 + \dots =$$

- $\frac{1}{1+x}$
- $\frac{1}{1-x^2}$
- $\frac{1}{1-x}$
- $\frac{1}{1+x^2}$

Question 16

What does the following expression give?

$$\int_a^b f(x) dx$$

- The summation of the curve between a and b.
- The area under the curve between a and b.

The area under the curve between a and b.

The average of the curve between a and b.

The slope of curve between a and b.

Question 17 What is the determinant of:

$$\begin{bmatrix} 6 & 9 \\ 4 & 2 \end{bmatrix}$$

42

6

-24

432

Question 18 What is the median of this set:

(1, 2, 5, 6, 6)

1

6

4

5

Question 19 Which of the following statements is true?

Statistics refer to both samples and population.

Statistics refer to samples. Parameters refer to populations.

Parameters refer to both samples and population.

Both statistics and parameters refer to samples.

Question 20 Python has all of the following characteristics except:

Compiled

Interactive

Object-orientated

Interpreted

Question 21 What is the probability of drawing a card with a prime number from a deck of cards (J = 11, Q = 12, K = 13)?

$\frac{12}{52}$

$\frac{6}{52}$

$\frac{6}{13}$

$\frac{4}{13}$

Question 22 The value of the integral

$$\int_0^{\pi/2} \cos(x) e^{-\sin x} dx$$

is:

$e^{-\sin 1}$

$1 - e^{-1}$

- $\cos 1$
 e^{-1}

Question 23 If rank A = N, then
 $\text{rank } A^T =$

- $\frac{N}{N+1}$
 N
 None of these
 $\frac{1}{N}$

Question 24 How many combinations are there of choosing 7 items from 9?

- 27
 72
 36
 63

Question 25 What is the output of the following code?

```
A = {1, 2, 3}
B = {1, 3, 4, 5}
C = {1, 2, 5, 7}
print(A & B | C)
```

- {1, 2, 3, 5, 7}
 {1, 3}
 {1, 2, 3}
 {1, 2, 3, 4, 5, 7}

Question 26 If $P(A) = 0.4$, $P(A|B) = 0.2$, and $P(B) = 0.6$, then find:
 $P(B|A)$

- 0.2
 0.3
 0.6
 0.4

Question 27 Consider the following partial differential equation:

$$2 \frac{\delta^2 u}{\delta x^2} + \frac{1}{2} \frac{\delta^2 u}{\delta y^2} = u$$

where $u = u(x, y)$ is the unknown function. Define the following functions:

$$u_1(x, y) = xy^2, u_2(x, y) = \sin(xy), \text{ and } u_3(x, y) = e^{\frac{1}{2}(x-2y)}$$

Which of these functions are solutions to the partial differential equation?

- Only u_3
 All the functions
 None of the functions

u_2 and u_3

Question 28

Find the solution to the following differential equation:

$$y'' + 2y' + y = 0, \quad y(0) = 2, \quad y'(0) = 10$$

- $y(t) = 2e^{-t} + 12te^{-t}$
- $y(t) = 2e^{-t}$
- $y(t) = e^{-t}$
- $y(t) = 2$

Question 29

According to the Central Limit Theorem, as a sample size gets large, the sampling distribution of the sample mean can be approximated as the:

- Uniform Distribution
- Normal Distribution
- Student's T Distribution
- Exponential Distribution

Question 30

Which of the following is the general solution for the differential equation:

$$y'' + 16y = 0$$

where A and B are arbitrary constants?

- $Ae^{4x} = y$
- $Ae^{4x} + Be^{4x} = y$
- $Ae^{-4ix} + Be^{4ix} = y$
- $Ae^{4ix} + Bxe^{-4ix} = y$

Question 31

Let $f : (0, \infty) \rightarrow (0, \infty)$ and $g : (0, \infty) \rightarrow \mathbb{R}$ be defined by

$$f(x) = \frac{1}{x} \text{ for every } x \in (0, \infty)$$

and

$$g(x) = \ln x \text{ for every } x \in (0, \infty)$$

Consider the following statements:

1. f is one-to-one
2. f is onto
3. g is one-to-one
4. g is onto

Which of the statements are true?

- None of the statements
- Statements 1 and 3
- All of the statements
- Statements 1, 2, and 3

Question 32

For each $n = 1, 2, 3, \dots$, define

$$f_n(x) = x(1 - x^{2n}) \text{ for every } x \in [-1, 1]$$

Then the function f defined by

$$f(x) = \lim_{n \rightarrow \infty} f_n(x)$$

exists for each $x \in [-1, 1]$ and is equal to:

$f(x) = \begin{cases} 0 & \text{if } |x| < 1 \\ 1 & \text{if } |x| = 1 \end{cases}$

$f(x) = 0$

$f(x) = x$

$f(x) = \begin{cases} x & \text{if } |x| < 1 \\ 0 & \text{if } |x| = 1 \end{cases}$

Question 33

What is the output of this program?

```
dict1 = {"key": "A", "key2": 2}
dict2 = {"key2": 2, "key": "A"}
print(dict1 == dict2)
```

The program gives an error

True True

True

False

Question 34

A type II error is:

Rejecting the null hypothesis when it is false.

Accepting the null hypothesis when it is true.

Rejecting the null hypothesis when it is true.

Accepting the null hypothesis when it is false.

Question 35

Which Python data structure is constructed using the code below?

```
a = (1,2,3)
```

List

Set

Dictionary

Tuple

Question 36

What is the output for this line of code:

```
12+2*24/3*4+4
```

20

3.75

452

80

Question 37

What does the following Python code return?

```
def func(x,y):
    if (x == 0):
        return y
    else:
        return func(x-1, x-y)
```

rule(4, 1)

- 5
- 4
- 4
- 5

Question 38

You roll a die. If the result is even you gain that many points. If the result is odd you lose that many points. What is the expected payoff of one roll?

- 3.5
- 1
- 0.5
- 2

Question 39

Find a particular solution to the differential equation:

$$y' = 3x^2 + 2x + 1 \text{ at } (2, 3)$$

- $y = x^3 + x^2 + x - 11$
- $y = x^3 + x^2 + x - 15$
- $y = x^3 + x^2 + x + 3$
- $y = x^3 + x^2 + x + 0$

Question 40

Which matrix is linearly independent?

- $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$
- $\begin{bmatrix} -2 \\ 5 \end{bmatrix} \begin{bmatrix} 16 \\ -40 \end{bmatrix}$
- $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \begin{bmatrix} 8 \\ 9 \\ 10 \end{bmatrix} \begin{bmatrix} 18 \\ 22 \\ 26 \end{bmatrix}$
- $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

Question 41

Given the first two terms in the Taylor series, what is the third term?

$$f(x) = f(a) + f'(a)(x-a) + \underline{\hspace{2cm}} + \dots$$

- $\frac{f''(a)}{2}(x-a)^2$
- $\frac{f''(a)}{2}(x-a)$
- $f''(a)(x-a)^2$
- $f''(a)(x-a)$

Question 42

What is the output of the following program?

```
print("Hello World"[::-1])
```

- d
-

- Hello worl
- The program gives an error
- dlrow olleH

Question 43 If $f(x) = \frac{1}{x+1}$, $x \neq -1$, and $g(f(x)) = x$ then find:
 $g(y)$

- $\frac{1}{y} + 1$
- $\frac{1}{y-1}$
- $\frac{1}{y+1}$
- $\frac{1}{y} - 1$

Question 44 What is the probability of getting a prime number when rolling a 6 sided die?

- $\frac{3}{6}$
- $\frac{2}{6}$
- Cannot be determined
- $\frac{4}{6}$

Question 45 What are the eigenvalues of:

$$\begin{bmatrix} 6 & -1 \\ 2 & 3 \end{bmatrix}$$

- (2, 5)
- (4, 5)
- (2, 3)
- (4, 6)

Question 46 Transpose:

$$\begin{bmatrix} 5 & 0 & 4 \\ 6 & 1 & 2 \\ 8 & 9 & 4 \end{bmatrix}$$

- $\begin{bmatrix} 0 & 5 & 4 \\ 1 & 6 & 2 \\ 9 & 8 & 4 \end{bmatrix}$
- $\begin{bmatrix} 4 & 9 & 8 \\ 2 & 1 & 6 \\ 4 & 0 & 5 \end{bmatrix}$
- None of these
- $\begin{bmatrix} 5 & 6 & 8 \\ 0 & 1 & 9 \\ 4 & 2 & 4 \end{bmatrix}$

Question 47 What is the range of this data set?

$$[11, 2, 3, 3, 6]$$

- 5
- 9
- 3
- 11

Question 48 If a student has a z-score of 0.5 on a test where the average was 60 and the standard deviation was 10, what was the student's test score?

- 70.5
- 65
- 60
- 55

Question 49 Python can be run:

- All of these
- In a Jupyter Notebook
- Using an editor such as IDLE
- At a command line

Question 50 Which of the following functions is differentiable at $x = 0$?

- $x^{1/3}$
- $|x|$
- $\ln(x)$
- $\tan(x)$

Question 51 How many permutations are there of the digits in the number "56789"?

- 6
- 120
- 24
- 720

Question 52 Which of the following numbers does this program not output?

```
x = 3
while x < 11:
    if x%2==0:
        x= x-1
    else:
        x=x*2
print(x)
```

- 6
- 4
- 18
- 9

Question 53 Python modules include all of the following machine learning libraries except:

- SciPy

- Numpy
- Pandas
- Dplyr

Question 54

Which of the statements below is the derivative of $f(x)$ at $x = a$?

- $\lim_{x \rightarrow a} \frac{f(x)+f(a)}{x-a}$
- $\lim_{x \rightarrow 0} \frac{f(x)+f(a)}{x-a}$
- $\lim_{x \rightarrow 0} \frac{f(x)-f(a)}{x-a}$
- $\lim_{x \rightarrow a} \frac{f(x)-f(a)}{x-a}$

Question 55

What is the output of this program?

```
= ["red", "blue", "yellow"]
'yellow' else "green" for x in prim_colors]
```

- ["red", "blue", "green"]
- ["green", "green", "green"]
- ["green", "green", "yellow"]
- ["red", "blue", "yellow"]

Question 56

What is the sum of:

$$\begin{bmatrix} 5 \\ 0 \\ 4 \end{bmatrix} + \begin{bmatrix} 6 \\ 6 \\ 2 \end{bmatrix} + \begin{bmatrix} 1 \\ 9 \\ 4 \end{bmatrix}$$

- 1054
- $\begin{bmatrix} 561 \\ 69 \\ 424 \end{bmatrix}$
- $\begin{bmatrix} 12 \\ 15 \\ 10 \end{bmatrix}$
- $\begin{bmatrix} 30 \\ 0 \\ 32 \end{bmatrix}$

Question 57

$$f(x) = (x^3 - 8)^{1/3}$$

Evaluate:

$$f'(x) =$$

- $\frac{x^2}{(x^3-8)^{2/3}}$
- $\frac{3x^2}{(x^3-8)^{-2/3}}$
- $\frac{1}{(x-8)^{2/3}}$
- $\frac{3x^2}{(x^3-8)^{2/3}}$

Question 58

What is the range of:

$$y = 3 \sin(\theta)$$

- 1 to 1
- $-\pi$ to π
- 3 to 3
- $-\infty$ to ∞

Question 59

Let $f : \mathbb{R}^2 \rightarrow \mathbb{R}$ be defined by

$$f((x, y)) = x^2 e^{-x-2y}, \text{ for every } (x, y) \in \mathbb{R}^2$$

The value of $f_x((0, 0)) + f_y((0, 0)) + f_{yy}((0, 0))$ is:

- Undefined
- 2
- 2
- 0

Question 60

What is the probability of picking 2 kings when selecting 2 cards from a 52 card deck?

- $(\frac{47}{51})(\frac{48}{52})$
- $\frac{1}{26}$
- $(\frac{3}{51})(\frac{4}{52})$
- $(\frac{1}{13})(\frac{1}{13})$

SUBMIT

