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Q1. a] Explain the concept of broadcasting in numpy Provide an example &.

→ 1] Broadcasting in numpy is a mechanisms that allows arrays with different shapes to be used together in arithmatic operations. When performing operations on arrays of different shapes, Numpy automatically "broad casts" the arrays to makes their shapes compatible without the need for explicit copying ~~of~~ of data.

2] This allows for efficient element - wise operations on arrays of different shapes.

Examples :-

```
        import numpy as np
      arr 1 = np. array ([[1,2,3],
                          [4,5,6],
                          [7,8, 9]])
     arr 2  = np. array ([10,20,30])
      result = arr 1 + arr2
     print ("Array 1 :")
     print ("arr 1")
     print ("\n array 2:")
     print ("arr 2")
     print ("\n Result after broad casting:")
     print (result)
```

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In this example :-

1) 'arr1' is a 3×3 array & 'arr2' is 1×3 array

2) Despite having different shapes Numpy automatically broad casts 'arr2' to match the shape of 'arr1'.

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Q.2] Describe the difference between np. dot () & np. matmul () in numpy when would you use each function

→

np. dot () function	np. matmul() function
① The np. dot () function perform the dot product of two arrays	① The np. matmut () function explicity performs matrix multiplication
② For 1-D arrays it perform inner product of vectors for 2-D arrays it performs matrix multiplications	② It does not perform elementwise multiplication like np dot() docs for 2D arrays.
③ For N-dimensional array its a sum product over the last axis of the second array.	③ It can handle higher dimensional arrays as well but behaviour is different compared to np. dot ()

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```
code :- import numpy asnp
a = np. array ([1,2,3])
b = np. array ([4,5,6])
dot. product = np. dot (a, b)
A = np. array ([[1,2],
               [3, 4]])
B = np. array ([[5, 6],
               [7, 8]])
matrix. product = np.dot AB
```

```
code :- import numpy as np
A = np. array ([[1,2],
               [3,4]])
B = np. array ([[5,6],
               [7,8]])
matrix product = np. matmul
                    (A,B)
```

Q.3]

→ a] To display the First 5 row of Dataframe sales. Data you can use the . head () method
import pandas as pd.

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b) To check the display the data types of each column in the Dataframe 'sales-data' you can use the Info () method.
print (sales-data , info ()).

Q.4)
→ c) To calculate the total sales amount for each transaction by adding a new column 'Total-sales' you can simply multiply the Quantity sold' column by hypothetical price-per-unit column & design the result to the new column 'Total-sales'. Assuming price-per-unit is also a column in the Dataframe.
Code :-
Sales -data ['Totalsales'] = sales - data [Quantity-sold]
sales - data ['' Price -per -unit]
This will create a new column 'Total sales' in the data frame sales data containing ~~to~~ the total sales amount for each ~~a~~ transaction.

d) To convert the 'transaction - Date' column from strings to data-time objects for better analysis, you can use pd. to = datetime () function.
Code:-
Sales -data ['Transaction - Date'] = pd. to -dateetime (sales)
data ['Transaction -Date'])
This will convert the Transaction-Date column from strings to datetime objects allowing for easier manipulation, filtering & analysis of dates in the Dataframe.

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Q.5]
→ To Findout the average quatintity sold per product you can group the data by product ID using the 'group by()' method & then calculate the mean of the Quantity-sold' for each product Here's how can archieve that:-
Code:-

```
average-quantity-per-product = sales-data.groupby
        ('Pro-duct-ID'] ['Quantity-sold]. mean()
print (average-quantity-per-product]
```

This will result in complete the average quantity sold for each product & ~~store~~ the result in a pandas series where the index reports the 'product-ID' & the values represent the average quantity sold you can use this series for further analysis or visualization.

Q.6]
→ a] Numerical python

Q.7)
→ c] arr= np. array (1,2,3)

Q8)
→ a) Create an array filled with zeros

Q.9]
→ a] A two dimensional labeled data structure.

Q 10] c) df ['column - name']

Q 11]
→ b] Students - data ['Age']

Q 12]
→ a] Sales - data ['Price'] sales-data ['Quntity - sold']

Q13]
→ a] ~~N~~ Numpy is primarily used for data manipulation & mathematical operations on homogeneous arrays. while pandas prodvides high level data structures & function to manipulate & analyze structur data like Dataframes

Q 14]
→ a] df. iloc [:3]

Q 15]
→ a] Drops all rows with missing values.

Q 17] ~~Q 16~~
→ a] df. sort - values ('column - name')

Q. 16] a] df. apply ()

Q 18] b] Returns the largest n values in a specific column.

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Q19]

→ c] df. to = csv ('output .csv')

Q.20]

→ b] Converts a column to database format

Q21]

→ a] df. fillna ( )