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Experiment no: 03  
Date: 30-07-2025

## EDA – Data Cleaning

**Aim:** To perform data cleaning by handling missing values, removing duplicates, converting data types, and normalizing data.

**Code:**

```
import pandas as pd

import numpy as np

from sklearn.preprocessing import StandardScaler, MinMaxScaler


# Step 1: Create sample dataset

data = {

    "ID": [1, 2, 3, 4, 5, 5],

    "Name": ["Alice", "Bob", "Charlie", "David", None, "David"],

    "Age": [23, 25, np.nan, 24, 22, 22],

    "Marks": [85, 78, 90, np.nan, 95, 95],

    "Department": ["CSE", "ECE", "ME", "CIVIL", "AI", "AI"]

}

df = pd.DataFrame(data)

print("Original Data:")

print(df)
```

# Step 2: Handling missing values

```
print("\nHandling Missing Values:")
```

```
print("Detect missing:\n", df.isnull().sum())
```

# Fill missing with mean for Age, fill with mode for Marks

```
df["Age"].fillna(df["Age"].mean(), inplace=True)
```

```
df["Marks"].fillna(df["Marks"].mode()[0], inplace=True)
```

# Fill missing Name with "Unknown"

```
df["Name"].fillna("Unknown", inplace=True)
```

```
print("\nAfter Filling Missing Values:")
```

```
print(df)
```

# Step 3: Remove duplicates

```
df = df.drop_duplicates()
```

```
print("\nAfter Removing Duplicates:")
```

```
print(df)
```

# Step 4: Data type conversion

```
df["ID"] = df["ID"].astype(str) # Convert ID to string
```

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```
print("\nAfter Data Type Conversion:")
```

```
print(df.dtypes)
```

# Step 5: Normalization

```
scaler = MinMaxScaler()
```

```
df["Marks_MinMax"] = scaler.fit_transform(df[["Marks"]])
```

```
standard_scaler = StandardScaler()
```

```
df["Age_Standardized"] = standard_scaler.fit_transform(df[["Age"]])
```

```
print("\nAfter Normalization:")
```

```
print(df)
```

## Output:

```
Original Data:
  ID  Name  Age  Marks Department
0  1  Alice  23.0  85.0        CSE
1  2   Bob  25.0  78.0        ECE
2  3  Charlie NaN  90.0        ME
3  4  David  24.0  95.0    CIVIL
4  5   None  22.0  95.0        AI
5  5  David  22.0  95.0        AI

Handling Missing Values:
Detect missing:
ID          0
Name        1
Age         1
Marks       1
Department  0
dtype: int64

After Filling Missing Values:
  ID  Name  Age  Marks Department
0  1  Alice  23.0  85.0        CSE
1  2   Bob  25.0  78.0        ECE
2  3  Charlie 23.2  90.0        ME
3  4  David  24.0  95.0    CIVIL
4  5  Unknown 22.0  95.0        AI
5  5  David  22.0  95.0        AI

After Removing Duplicates:
  ID  Name  Age  Marks Department
0  1  Alice  23.0  85.0        CSE
1  2   Bob  25.0  78.0        ECE
2  3  Charlie 23.2  90.0        ME
3  4  David  24.0  95.0    CIVIL
4  5  Unknown 22.0  95.0        AI
5  5  David  22.0  95.0        AI
```

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```
After Data Type Conversion:
ID      object
Name    object
Age     float64
Marks   float64
Department  object
dtype: object

After Normalization:
   ID  Name  Age  Marks  Department  Marks_MinMax  Age_Standardized
0  1  Alice  23.0  85.0         CSE      0.411765      -0.187867
1  2   Bob  25.0  78.0         ECE      0.000000      1.690806
2  3  Charlie  23.2  90.0          EE      0.705882      0.900000
3  4   David  24.0  55.0        CIVIL      1.000000      0.751465
4  5  Unknown  22.0  95.0          AI      1.000000     -1.127284
5  5   David  22.0  95.0          AI      1.000000     -1.127284

/tap/python-input-2005816956.py:22: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

df["Age"].fillna(df["Age"].mean(), inplace=True)
/tap/python-input-2005816956.py:23: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

df["Marks"].fillna(df["Marks"].mode()[0], inplace=True)
/tap/python-input-2005816956.py:26: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.

df["Name"].fillna("Unknown", inplace=True)
```

**Result:** Successfully cleaned the dataset by handling missing values, removing duplicates, converting data types, and normalizing data.