Pandas is a powerful python code library used for data manipulation and analysis. Here's a comprehensive overview of **all major Pandas operations**, grouped into categories for easier understanding:

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1. Importing Pandas

python code

```
import pandas as pd
```

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2. Creating Data Structures

- **Series**: 1D labeled array.

python code

```
s = pd.Series([1, 2, 3])
```

- **DataFrame**: 2D labeled data.

python code

```
df = pd.DataFrame({'A': [1, 2], 'B': [3, 4]})
```

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3. Reading and Writing Data

- **CSV**

python code

```
df = pd.read_csv('file.csv')
df.to_csv('output.csv')
```

- **Excel**

python code

```
df = pd.read_excel('file.xlsx')
df.to_excel('output.xlsx')
```

- **JSON**

python code

```
df = pd.read_json('file.json')
df.to_json('output.json')
```

---

4. Viewing Data

python code

```
df.head()          # First 5 rows
df.tail(3)         # Last 3 rows
df.info()          # Summary info
df.describe()      # Statistical summary
df.shape           # Rows and columns
df.columns         # Column names
df.index           # Index values
```

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5. Selecting Data

- **Columns**

python code

```
df['A']            # Single column
df[['A', 'B']]     # Multiple columns
```

- **Rows**

python code

```
df.loc[0]          # By label/index
df.iloc[1]         # By integer position
```

- **Slicing**

python code

```
df[1:4]            # Slice rows
```

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6. Filtering / Conditional Selection

python code

```
df[df['A'] > 2]     # Rows where A > 2
```

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7. Adding / Modifying Columns

python code

```
df['C'] = df['A'] + df['B']     # New column
df['A'] = df['A'] * 10          # Modify column
```

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8. Deleting Data

python code

```
df.drop('C', axis=1, inplace=True)     # Drop column
df.drop(0, axis=0, inplace=True)       # Drop row
```

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9. Handling Missing Data

python code

```
df.isnull()                 # Check missing
df.dropna()                 # Drop rows with NaN
df.fillna(0)                # Fill NaN with 0
```

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10. Aggregation and Grouping

python code

```
df.sum()
df.mean()
df.groupby('Category').sum()
```

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11. Sorting

python code

```
df.sort_values('A')         # By column
df.sort_index()             # By index
```

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12. Merging / Joining

python code

```
pd.concat([df1, df2])           # Combine along axis
pd.merge(df1, df2, on='key')    # SQL-style join
```

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13. Pivot Table / Crosstab

python code

```
df.pivot_table(values='value', index='A', columns='B')
pd.crosstab(df['A'], df['B'])
```

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14. Applying Functions

python code

```
df.apply(np.sqrt)              # Apply function to DataFrame
df['A'].map(lambda x: x*2)     # Apply to Series
```

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15. DateTime Operations

python code

```
df['date'] = pd.to_datetime(df['date'])
df['year'] = df['date'].dt.year
```

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16. Exporting Data

python code

```
df.to_csv('output.csv')
df.to_excel('output.xlsx')
```

---

17. Indexing / Setting Index

python code

```
df.set_index('id', inplace=True)
df.reset_index(inplace=True)
```

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18. Duplicates and Unique

python code

```
df.duplicated()
df.drop_duplicates()
df['A'].unique()
```