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Variable

In Exploratory Data Analysis (EDA), understanding the types of variables is crucial as it dictates the kind of analysis and visualizations you can perform. Variables are typically classified into the following types:

### **1. Based on Measurement Level**

#### **a. Quantitative Variables (Numerical Variables)**

* Represent numeric values and allow arithmetic operations.
* **Types:**
  1. **Continuous Variables:** Values can take any number within a range (e.g., height, weight, temperature).  
      Example: 73.5 kg, 23.8°C.
  2. **Discrete Variables:** Take whole number values (e.g., number of students, count of cars).  
      Example: 3 students, 7 cars.

#### **b. Qualitative Variables (Categorical Variables)**

* Represent categories or groups, not numbers.
* **Types:**
  1. **Nominal Variables:** Categories without a specific order.  
      Example: Colors (Red, Blue, Green), Gender (Male, Female).
  2. **Ordinal Variables:** Categories with a meaningful order, but differences between them are not defined.  
      Example: Education level (High School < Bachelor's < Master's).

### **2. Based on Data Collection**

#### **a. Independent Variables (Predictor Variables)**

* Variables used to predict or explain outcomes.
* Example: Age, Hours Studied in predicting exam scores.

#### **b. Dependent Variables (Response Variables)**

* The outcome or result being studied.
* Example: Exam Score depends on Hours Studied.

### **3. Based on Behavior in Analysis**

#### **a. Time Variables**

* Variables that change with time.
* Example: Year, Month, Timestamp.

#### **b. Identifier Variables**

* Unique identifiers for rows or observations.
* Example: Customer ID, Order ID.

### **4. Based on Encoding**

#### **a. Binary Variables**

* Variables with two possible values (0/1 or True/False).
* Example: Yes/No, Has Credit Card.

#### **b. Dummy Variables**

* Categorical variables converted into binary format for modeling.
* Example: Gender (Male=1, Female=0).

### **Summary Table**

| **Type** | **Sub-Type** | **Examples** |
| --- | --- | --- |
| **Quantitative** | Continuous | Height, Weight, Temperature |
|  | Discrete | Number of Students, Count of Cars |
| **Qualitative** | Nominal | Colors, Gender, Blood Group |
|  | Ordinal | Education Level, Satisfaction Rating |
| **Behavior in Analysis** | Time Variables | Year, Month, Timestamp |
|  | Identifier Variables | Customer ID, Product Code |
| **Encoding** | Binary | Yes/No, Has Credit Card |
|  | Dummy Variables | Male=1, Female=0 |

### **Visualization Suggestions:**

* **Numerical Variables:** Histograms, Boxplots, Scatter Plots.
* **Categorical Variables:** Bar Charts, Pie Charts.
* **Time Variables:** Line Charts.
* **Binary Variables:** Stacked Bar Charts.