Lab 01 - The Importance of Inventory Management

Assignment: Dollar-by-Value (DBV) Analysis

Objective

In this assignment, you will develop a simple computer program to analyze inventory data using the **Dollar-by-Value (DBV)** method.
The goal is to identify which items contribute most to the total annual expenditure and visualize this distribution using a **Pareto chart**.
You will also interpret what these findings mean for inventory management.

---

1. Program Requirements

Your program should:

1. **Read a spreadsheet file** (Excel or CSV) containing the following columns for *n* items:
   - **Item ID**
   - $\boldsymbol{D_i}$: Annual usage (units/year)
   - $\boldsymbol{v_i}$: Unit cost ($/unit)
2. **Compute for each item:**
   - **Dollar usage:**

$$w_i = D_i * v_i$$

   - **Share of total dollar usage:**

$$s_i = \frac{w_i}{\sum w_i}$$

   - **Rank** items in descending order of w_i
   - **Cumulative percentage:**

$$c_i = \sum_{r \le i} s_r$$

3. **Generate and display:**
   - A **DBV table** showing the results.
   - A **Pareto (DBV) graph** showing the cumulative percentage of total dollar usage against the percentage of items.
   - Clear labeling of **A**, **B**, and **C** item classes (e.g., A = top 80%, B = next 15%, C = remaining 5%).

---

2. Input Data

Use the following dataset for testing your program:

Item, i	ID	D_i (units/year)	v_i ($/unit)
1	A	80	422.33
2	B	514	54.07
3	C	19	0.65
4	D	2,442	16.11
5	E	6,289	4.61
6	F	128	0.63
7	G	1,541	2.96
8	H	4	22.05
9	I	25	5.01
10	J	2,232	2.48
11	K	2	4.78
12	L	1	38.03
13	M	6	9.01
14	N	12	25.89
15	O	101	59.50
16	P	715	20.78
17	Q	1	2.93
18	R	35	19.52
19	S	1	28.88
20	T	4	29.86

3. Expected Output

Your program should produce:

1. **A DBV Table** showing for each item:
    - Item ID
    - $\boldsymbol{D_i}$
    - $\boldsymbol{v_i}$
    - $w_i = D_i * v_i$
    - % of total dollar usage
    - Cumulative % of total dollar usage
    - Rank (1 = highest w_i)
    - Class (A, B, or C)
2. **A Pareto Chart**
    - X-axis: cumulative % of items
    - Y-axis: cumulative % of dollar usage
    - Highlight 80% and 95% cutoff lines for A/B/C classification.
3. **A Short Written Summary** (5–8 lines) discussing:
    - Which few items dominate total dollar usage.
    - How management should handle A, B, and C items differently.

---

4. Discussion Questions

Answer the following using your program results:

1. What **percentage of total dollar usage** is contributed by:
    - The **top 20% of items** (the 4 most expensive by usage value)?
    - The **bottom 50% of items** (the 10 least expensive by usage value)?

    *(For this dataset, the top 20% contribute approximately **80%**, and the bottom 50% contribute only about **0.3%**.)*

2. What practical meaning does this have for **inventory control**?

---

5. Deliverables

Submit the following:

1. **Your program code** (Python Interactive Notebook, i.e. ".ipynb" extension).
2. **Input data file** (Excel/CSV).
3. **Output DBV table** (exported Excel/CSV).
4. **Pareto chart** (inserted in the report).
5. A **short report (2–3 pages)** containing:
    - Title, objective, method, and key findings.
    - DBV table and chart.
    - Discussion of results and management implications.
    - The computed percentages for the top 20% and bottom 50%.

---

6. Evaluation Criteria

Criterion	Description	Weight
Correctness of calculations	Accurate DBV computation and percentages	35%
Graph quality	Clear, labeled, and readable Pareto chart	15%
Clarity of explanation	Logical discussion of findings	20%
Code quality and documentation	Well-organized, easy to run	20%
Presentation and formatting	Professional and clear layout	10%

Bonus Challenge (Optional)

Enhance your program to:

- Let users adjust the ABC cutoff thresholds (e.g., 75–90 or 85–95).
- Show how the classification changes.
- Comment on how this affects management priorities.
