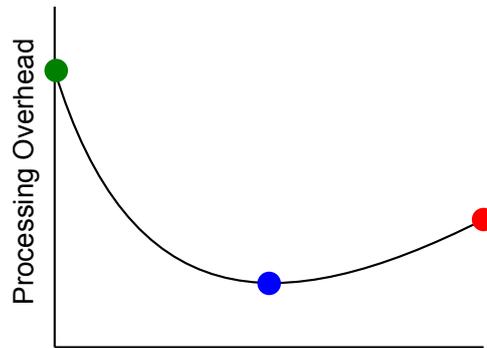


## Advanced Topics in Databases

### Exercise 2

1. **[Group 6]** Explain the vectorized execution model. Compare it briefly with the Tuple-at-a-Time and the Operator-at-a-Time processing model. Describe the impact of the vector size.
2. **[Group 7]** Consider the following DBMSs:
  - MonetDB/MIL (Operator-at-a-Time)
  - MySQL (Tuple-at-a-Time)
  - MonetDB/X100 (Vector-at-a-Time)

Assign the different DBMSs to the following performance diagram of the TPC-H Query 1 (Data size: 1 GB):



What unit is used on the x axis? Explain the performance difference of the different systems.

3. **[Group 8]** For which of the following scenarios would you use a tuple-at-a-time or an operator-at-a-time processing model?
  - Disk-based systems with small main memory.
  - Maximize instructions-per-cycle.
  - Nested-loops join on very large tables.
  - In-memory database with maximum CPU utilization.
  - Avoid big intermediate results.
  - Minimize instruction cache misses
4. **[Group 9]** Describe the two different storage models presented in the lecture. Especially, consider the following aspects:
  - (a) Compression techniques
  - (b) Query execution

5. [Group 10] Consider the following table Shops:

ID (int)	Shop (Char 10)	Revenue (Double)	City (Char 20)
1	H&M	1357,68	Berlin
2	C&A	2766,12	Dresden
3	McDonalds	30000,23	Magdeburg
4	PizzaHut	11999,99	Berlin
5	H&M	24135,76	Dortmund

Explain how the data would be stored within the cache (Cache line: 64 byte, Cache size: 6 lines).

How many cache lines must be loaded for the following queries:

- `SELECT * FROM Shops where revenue >10.000;`
  - `INSERT INTO Shops VALUES(6,'New Yorker', 16724.35,'Stuttgart');`
  - `SELECT SUM(revenue) FROM Shops WHERE City='Berlin';`
  - `SELECT Shop FROM Shops GROUP BY Shop HAVING COUNT(*) >1;`
6. [Group 11] Why is lightweight data compression so important, especially for main-memory DBMSs? Explain the basic principle of dictionary encoding? Use a self-chosen example. Explain how dictionary encoded data can be processed without decompressing it!
7. [Group 12] Explain and compare different materialization strategies for column-stores. What are their advantages?

**Good Luck!**