Q.1	What is OLTP?
	OLTP (on-line transaction processing) – Major task of traditional relational DBMS – Day-to-day operations: purchasing, inventory, banking, manufacturing, payroll, registration, accounting, etc. – Aims at reliable and efficient processing of a large number of transactions and ensuring data consistency
Q.2	What is OLAP?
	OLAP (on-line analytical processing) – Major task of data warehouse system – Data analysis and decision making – Aims at efficient multidimensional processing of large data volumes • Fast, interactive answers to large aggregate queries
Q.3	Distinct features (OLTP vs. OLAP)
	– User and system orientation: customer vs. market – Data contents: current, detailed vs. historical, consolidated – Database design: ER + application vs. star + subject – View: current, local vs. evolutionary, integrated – Access patterns: update vs. read-only but complex queries
Q.4	OLTP vs. OLAP

	OLTP	OLAP
Target	operational needs	business analysis
Data	small, operational data	large, historical data
Model	normalized	denormalized/ multidimensional
Query language	SQL	not unified – but MDX is used by many
Queries	small	large
Updates	frequent and small	infrequent and batch
Transactional recovery	necessary	not necessary
Optimized for	update operations	query operations

Q.5	What is ROLAP? What are its Pros and Cons?

ROLAP

- Relational OLAP
- Data stored in relational tables
  - Star (or snowflake) schemas used for modeling
  - SQL used for querying
- Pros
  - Leverages investments in relational technology
  - Scalable (billions of facts)
  - Flexible, designs easier to change
  - New, performance enhancing techniques adapted from MOLAP
    - Indices, materialized views
- Cons
  - Storage use (often 3-4 times MOLAP)
  - Response times

Product ID	Store ID	Sales
1	3	2
2	1	7
3	2	3
...	...	...

Q.6	What is MOLAP? What are its Pros and Cons?

- Multidimensional OLAP
- Data stored in special multidimensional data structures
  - E.g., multidimensional array on hard disk
- Pros
  - Less storage use ("foreign keys" not stored)
  - Faster query response times
- Cons
  - Up till now not so good scalability
  - Less flexible, e.g., cube must be re-computed when design changes
  - Does not reuse an existing investment (but often bundled with RDBMS)
  - Not as open technology

MOLAP data cube

$d_2 \backslash d_1$	1	2	3
1	0	7	0
2	2	0	0
3	0	0	3

Q.7	What is HOLAP? What are its Pros and Cons?

	- Hybrid OLAP
	- Detail data stored in relational tables (ROLAP)
	- Aggregates stored in multidimensional structures (MOLAP)
	- Pros
	   - Scalable (as ROLAP)
	   - Fast (as MOLAP)
	- Cons
	   - High complexity

Q.8	SQL, OLAP, and Data Mining
	## SQL, OLAP, and Data Mining |	SQL	OLAP	Data Mining
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Task	Extraction of detailed and summary data	Summaries, trends and forecasts	Knowledge discovery
Type of result	Information	Analysis	Insight and Prediction
Method	Deduction (Ask the question, verify with data)	Multidimensional data modeling, Aggregation, Statistics	Induction (Build the model, apply it to new data, get the result)
Example question	Who purchased mutual funds in the last 3 years?	What is the average income of mutual fund buyers by region by year?	Who will buy a mutual fund in the next 6 months and why?	
Q.9	Typical OLAP Operations

- Roll up (drill-up): summarize data
  - *by climbing up hierarchy or by dimension reduction*
- Drill down (roll down): reverse of roll-up
  - *from higher level summary to lower level summary or detailed data, or introducing new dimensions*
- Slice and dice
  - *project and select*
- Pivot (rotate)
  - *reorient the cube, visualization, 3D to series of 2D planes.*
- Other operations
  - *drill across: involving (across) more than one fact table*
  - *drill through: through the bottom level of the cube to its back-end relational tables (using SQL)*