

## Questions for the exam

In the exam there will be “fill in the blank” type questions for which you can use the following concepts/notions.

alert log	heap-organized table	segment
background process	hint	sequence
buffer	index-organized table	sequential file
cluster key	multi-level index	sparse index
clustered table	nonvolatile device	subpartition
composite index	online redo log	synonym
control file	partition	system global area
data block	partitioned index	table cluster
data file	partitioned table	tablespace
database instance	partitioning	temp file
deadlock	RAID level 0,1,2,3,4,5,6	temporary tablespace
dense index	reverse key index	tertiary storage
disk block	rotational latency	transfer time
dynamic SQL	secondary index	view
extent	secondary storage	volatile device
function-based index	seek time	

You will get true/false questions, “fill in the gap” questions, and practical questions (like in practice tests). During the exam you should log in to a Teams meeting.

**The following questions can help you to prepare for the exam:**

- What are the most important files (file types) in an Oracle database? (01\_Oracle\_storage.pptx 1.)
- Give the most important memory structures of an Oracle instance. (01\_Oracle\_architecture.pptx 5.)
- Give the most important processes of an Oracle instance. (01\_Oracle\_architecture.pptx 5.)
- List 5 data dictionary views in an Oracle database.
- List 10 different schema objects in an Oracle database.
- List 5 different objects in an Oracle database which are not in a user’s schema.
- What is a sequence in an Oracle database? Give SQL examples for the creation and usage.  
(01\_Oracle\_architecture.pptx 15-17.)
- Give the data storage concepts (segment, extent etc.) in an Oracle database, and draw the relationships among them.  
(01\_Oracle\_storage.pptx 8.)
- Describe RAID level 0, 1, 2, 3, 4, 5, 6 technology. (02\_RAID.docx)
- What does it mean: spanned vs unspanned record? Draw example data blocks for both. (02\_UW\_file\_structure 27-29.)
- Give 3 sequencing options for records. (02\_UW\_file\_structure 31-33.)
- What is the difference between a purely physical and a fully indirect record reference? (02\_UW\_file\_structure 35-37.)
- Describe the difference between row store and column store. Give example records for both.  
(02\_UW\_file\_structure 55-58.)
- What is the difference between a sparse index and a dense index? (03\_UW\_indexing 5.)
- What is the difference between a primary index and secondary index? (03\_UW\_indexing 12.)
- What is a clustering index? (03\_UW\_indexing.ppt 49.)
- Insert the following keys into a given B+ tree ...
- What is the difference between a B-tree and a B+ tree? (03\_UW\_indexing 88.)
- What is a bitmap index? What are there in the leaf nodes? (04\_Bitmap\_indexes)
- Compress the following bitvector with run-length encoding ...

Decompress the following compressed bitvector ...

What is dynamic hashing? (04\_UW\_hashing 18.)

Build a linear hash structure from the following key values ...

Build an extensible hash structure from the following key values ...

What is the most important cost factor in query execution? (05\_optimization 9.)

Give the meaning of the following notations that we use in cost estimation:  $T(R)$ ,  $B(R)$ ,  $bf(R)$ ,  $V(R,A)$ ,  $SC(R,A)$ . (05\_optimization 10.)

What is the average cost of a selection operation ( $\sigma_{A=x}R$ ) if we use a clustered B+ tree index? in case of single record/multiple record (05\_optimization 12.)

What is the average cost of a selection operation ( $\sigma_{A=x}R$ ) if we use a secondary B+ tree index? in case of key field/nonkey field (05\_optimization 13.)

Describe the external Sort-Merge algorithm. What is the cost of it? (05\_optimization 21.)

What is the cost of a Nested Loop join algorithm? (best case/worst case) (05\_optimization 25.)

What is the cost of a Block Nested Loop join algorithm? (best case/worst case) (05\_optimization 27.)

What is the cost of the improved Block Nested Loop join algorithm? (05\_optimization 29.)

Describe the Indexed Nested Loop join algorithm? What is the cost of it? (05\_optimization 30.)

Describe the Sort-merge join algorithm. What is the cost of it? (05\_optimization 31.)

Describe the Hash-join algorithm? What is the cost of it? (05\_optimization 32.)

What is materialization and pipelining? (05\_optimization 33.)

Give some basic relational algebra expression equivalence rules (05\_optimization 39.)

- conjunctive selection decomposition (05\_optimization 39.)
- distribution of selection over join (05\_optimization 39.)
- distribution of projection over join (05\_optimization 39.)
- associativity of joins, products, union (05\_optimization 39.)

Give the meaning of the following index options: (05\_special\_storage 8.)

- composite index
- function-based index
- compressed index

What is a partitioned table? (05\_special\_storage 11.)

List the partitioning types an Oracle database supports (05\_special\_storage 12-13.)

Give the properties of an Index-Organized Table (05\_special\_storage 16.)

Give a diagram about two clustered tables (05\_special\_storage 18.)

Give estimation for the number of blocks of a product operation:  $B(R \times S)$  (06\_UW\_query\_proc 47.)

What is Selection Cardinality? (06\_UW\_query\_proc 50.)

Give estimation for the number of rows of a join operation:  $T(R \bowtie S)$  (06\_UW\_query\_proc 54.)

Give estimation for the number of rows of  $\sigma_{A \leq x}R$  (06\_UW\_query\_proc 59.)

Give estimation for the number of rows of  $\sigma_{\theta_1 \wedge \theta_2 \wedge \dots \wedge \theta_n}R$  (06\_UW\_query\_proc 59.)

Give estimation for the number of rows of  $\sigma_{\theta_1 \vee \theta_2 \vee \dots \vee \theta_n}R$  (06\_UW\_query\_proc 59.)

Give the main steps of query optimization (diagram) (06\_UW\_query\_proc 17.)

Give two conventional wisdom rules about query optimization (06\_UW\_query\_proc 41.)

What is the difference between ALL\_ROWS and FIRST\_ROWS optimization modes? (07\_tuning 6.)

What does an EXPLAIN PLAN statement do? (07\_tuning 15.)

What is stored in PLAN\_TABLE? (07\_tuning 15.)

What is a Full Table Scan operation (07\_tuning 18.)

What is an Index Unique Scan operation (07\_tuning 25.)

What is an Index Range Scan operation (07\_tuning 27.)

What is Clustering Factor? (07\_tuning 40.)

What is the difference between Explain Plan and Tracing? (07\_tuning 69.)

What can we do with hints? (07\_tuning 72.)

What can we do with ANALYZE command? (07\_tuning 74.)

What does it mean: a consistent database? (09\_UW\_crash\_recovery 4.)

What is a transaction? (09\_UW\_crash\_recovery 10.)

How can constraints be violated? (09\_UW\_crash\_recovery 12.)

What are undesired expected events? (09\_UW\_crash\_recovery 15.)

Give the 3 important address spaces of a DBMS. (09\_UW\_crash\_recovery 18.)

Describe the following operations: read, write, input, output. (09\_UW\_crash\_recovery 20.)

What does "atomicity" property of a transaction mean? (09\_UW\_crash\_recovery 27.)

Describe UNDO logging rules. (09\_UW\_crash\_recovery 38.)

Give the write order to disk in case of UNDO logging (09\_UW\_crash\_recovery 39.)

Give the recovery rules in case of UNDO logging. (09\_UW\_crash\_recovery 43.)

Give the UNDO recovery steps if you see the following log records on disk ...

What happens when a failure occurs during recovery from UNDO log? (09\_UW\_crash\_recovery 44.)

Give the steps of a simple checkpoint in UNDO logging. (09\_UW\_crash\_recovery 50.)

Give the steps of a non-quiescent checkpoint in UNDO logging. (09\_UW\_crash\_recovery 51.)

To which point do we have to scan backwards in UNDO log if we use checkpoint? (09\_UW\_crash\_recovery 53.)

Describe REDO logging rules. (09\_UW\_crash\_recovery 59.)

Give the write order to disk in case of REDO logging (09\_UW\_crash\_recovery 60.)

Give the recovery rules in case of REDO logging. (09\_UW\_crash\_recovery 64.)

Give the REDO recovery steps if you see the following log records on disk ...

Give the steps of a non-quiescent checkpoint in REDO logging. (09\_UW\_crash\_recovery 67.)

To which point do we have to scan backwards in REDO log if we use checkpoint? (09\_UW\_crash\_recovery 69.)

What are the key drawbacks of UNDO log and REDO log? (70.)

Describe UNDO/REDO logging rules. (09\_UW\_crash\_recovery 72.)

Give the recovery rules in case of UNDO/REDO logging. (09\_UW\_crash\_recovery 73.)

Give the steps of a non-quiescent checkpoint in UNDO/REDO logging. (09\_UW\_crash\_recovery 75.)

What is concurrency control (10\_UW\_concurrency 3.)

What is a schedule? (10\_UW\_concurrency 6., 14.)

What is a serial schedule? (10\_UW\_concurrency 6.)

What is a serializable schedule? (10\_UW\_concurrency 9.)

What does it mean: "conflict equivalent"? (10\_UW\_concurrency 23.)

What does it mean: "conflict serializable"? (10\_UW\_concurrency 23.)

What is a precedence graph? (10\_UW\_concurrency 26.)

What can we say if two schedules are conflict equivalent? (10\_UW\_concurrency 29.)

Give two schedules whose precedence graphs are the same, but not confl. equivalent. (10\_UW\_concurrency 31.)

Construct the precedence graph for the following schedule ...

What can we state about precedence graphs? (10\_UW\_concurrency 32.)

What does "consistency of a transaction" mean? (10\_UW\_concurrency 37.)

What does "legality of schedules" mean? (10\_UW\_concurrency 38.)

What does "two phase locking" mean? (10\_UW\_concurrency 42.)

What is a deadlock? How can we detect it? (10\_UW\_concurrency 51-54.)

What can we state about legal schedules of consistent 2PL transactions? (10\_UW\_concurrency 50.)

Give a serializable schedule which cannot be achieved via 2PL (10\_UW\_concurrency 58.)

What does "consistency of a transaction" mean in case of shared/exclusive locks? (10\_UW\_concurrency 63.)

What is legality of schedules in case of shared/exclusive locks? (10\_UW\_concurrency 64.)

What is the compatibility matrix? Give it for the shared/exclusive locking system. (10\_UW\_concurrency 68.)

Give the compatibility matrix for shared/exclusive/increment locking system. (10\_UW\_concurrency 74.)

Give the compatibility matrix for shared/exclusive/update locking system. (10\_UW\_concurrency 77.)

How DBMS-es guarantee 2PL in practice? (10\_UW\_concurrency 80.)

What information can we find in Lock Tables of a DBMS? (10\_UW\_concurrency 82-84.)

What is the advantage/disadvantage of locking large objects? (10\_UW\_concurrency 87.)

What is the advantage/disadvantage of locking small objects? (10\_UW\_concurrency 87.)