E-COMMERCE SYSTEMS

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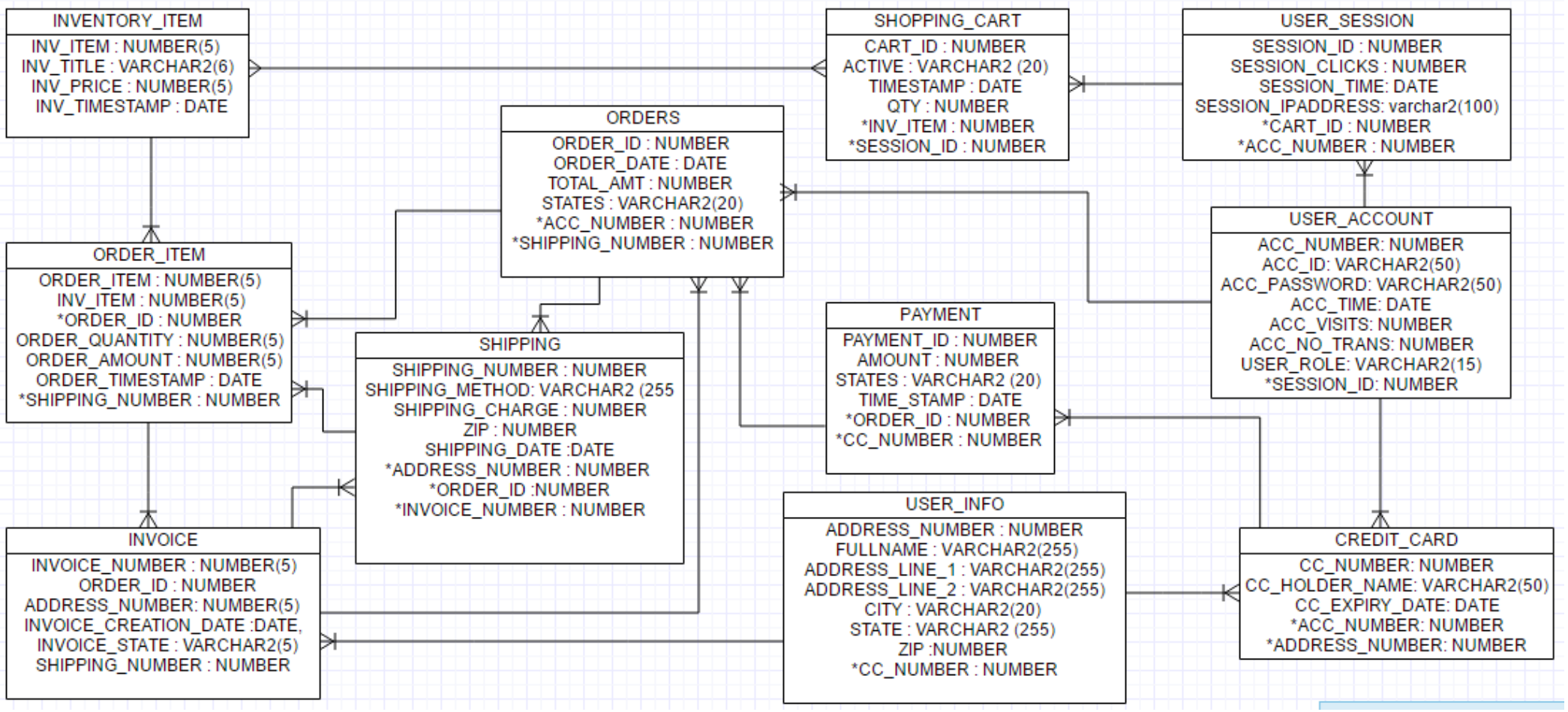
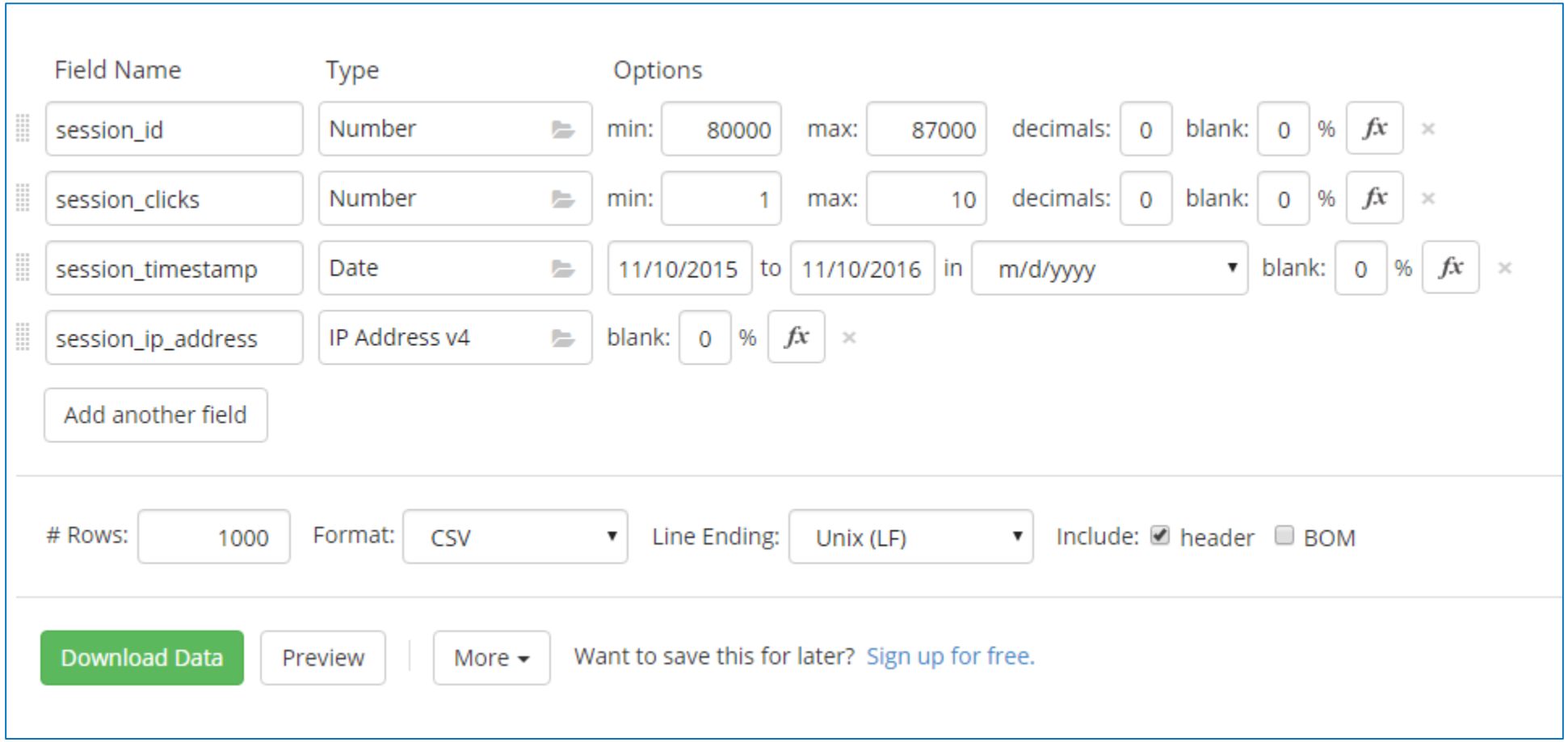
RELATIONAL DATABASE DESIGN



DATA GENERATION

https://www.mockaroo.com



DATA GENERATION(contd)

Table	Number of Tuples
INVENTORY_ITEM	5000
ORDER_ITEM	5000
INVOICE	5000
USER_SESSION	1000
USER_ACCOUNT	5000
CREDIT_CARD	5000
SHOPPING_CART	5000
ORDERS	5000
PAYMENT	5000
ADDRESS	5000
SHIPPING	5000

QUERY WRITING

```
SELECT UA.ACC_NUMBER, UA.ACC_ID, II.INV_PRICE
FROM USER_ACCOUNT UA
JOIN USER_SESSION US
ON UA.SESSION_ID = US.SESSION_ID
JOIN SHOPPING_CART SC
ON US.CART_ID = SC.CART_ID
JOIN INVENTORY_ITEM II
ON SC.INV_ITEM = II.INV_ITEM
WHERE UA.ACC_VISITS > 100
ORDER BY II.INV_PRICE DESC;
```

QUERY WRITING(contd)

Users having more than 100 visits and have ordered higher cost of items

Script Output | Query Result

SQL | Fetched 350 rows in 0.314 seconds

	ACC_NUMBER	ACC_ID	INV_PRICE
1	90757	Kathleen.M.Sabo@spambob.com	9924
2	90808	Linda.J.Jones@mailinator.com	9924
3	92451	Margaret.J.Hickman@pookmail.com	9924
4	92502	John.S.Redmon@mailinator.com	9924
5	92859	Charlotte.A.Glass@dodgit.com	9924
6	92910	Michael.E.Lipscomb@trashymail.com	9924
7	93196	David.P.Zimmerman@dodgit.com	9924
8	93247	Ruth.S.Motyka@spambob.com	9924
9	90553	Hope.S.Palm@pookmail.com	9924

DATABASE PROGRAMMING

- Stored Procedure to check user_role before inserting a record into inventory table
- If the user is ‘Admin’, only then the insertion is allowed
- Every time Administrator tries to insert new record in INVENTORY_ITEM table, procedure ‘UpdateInventory’ is invoked

```
CREATE OR REPLACE Procedure UpdateInventory
   ( user_id IN number, title_in IN VARCHAR2, price IN NUMBER)

IS

   urole VARCHAR2(15);

   CURSOR c1 IS
       SELECT user_role
       FROM user_account
       WHERE acc_number = user_id;

BEGIN

   OPEN c1;
   FETCH c1 INTO urole;

   WHILE c1 = 'Admin'
   LOOP
       INSERT INTO INVENTORY_ITEM
       ( inv_title, inv_price, inv_timestamp)
       VALUES
       ( title_in, price_in, sysdate);
   END LOOP;

   CLOSE c1;

   END;
```

PERFORMANCE TUNING

- Indexing
  - B Tree
  - Bitmap
- Parallelism

INDEXING – B TREE

- Before

Query Result

SQL | Fetched 50 rows in 0.146 seconds

	ORDER_ITEM	ORDER_QUANTITY	ORDER_AMOUNT	ORDER_TIMESTAMP	INVOICE_CREATION_DATE	TOTAL ROWS
1	20378	830	1001	17-OCT-16	02-APR-15	1
2	20378	830	1001	17-OCT-16	04-JUL-15	1

Query Result | Autotrace

SQL HotSpot | 3.473 seconds

OPERATION	OBJECT_NAME	CARDINALITY	COST
SELECT STATEMENT			21
FILTER			
Filter Predicates			
COUNT(*)=1			
SORT (GROUP BY)		84	21
HASH JOIN		8384	20
Access Predicates			
ORD.ORDER_ID=INV.ORDER_ID			

INDEXING – B TREE

- After

Script Output | Query Result | Autotrace

SQL | Fetched 50 rows in 0.072 seconds

	ORDER_ITEM	ORDER_QUANTITY	ORDER_AMOUNT	ORDER_TIMESTAMP	INVOICE_CREATION_DATE	TOTAL ROWS
1	20378	830	1001	17-OCT-16	02-APR-15	1
2	20378	830	1001	17-OCT-16	04-JUL-15	1
3	20378	830	1001	17-OCT-16	17-JUL-15	1
4	20378	830	1001	17-OCT-16	29-JAN-16	1

Query Result | V$SQL_PLAN.SQL_ID=gvym1cpx045d0 | Script Output | Autotrace

SQL HotSpot | 1.788 seconds

OPERATION	OBJECT_NAME	CARDINALITY	COST	LA
SELECT STATEMENT			13	
FILTER				
Filter Predicates				
COUNT(*)=1				
SORT (GROUP BY)		16	13	
HASH JOIN		1677	12	
Access Predicates				
ORD.ORDER_ID=INV.ORDER_ID				
TABLE ACCESS (FULL)	ORDER_ITEM	1677	6	

INDEXING - BITMAP

- Before

Script Output × | Autotrace × | Query Result ×

SQL | Fetched 50 rows in 2.21 seconds

	ACC_NUMBER	ACC_VISITS	FULLNAME	CITY	CC_EXPIRY_DATE
1	91511	9999	TRUE	GLENBURN	28-JAN-19
2	93873	9996	TRUE	LEVERETT	10-FEB-19
3	93294	9994	FALSE	BEDFORD	28-FEB-19
4	92638	9993	TRUE	PITTSFIELD	28-FEB-19

SQL HotSpot | 2.235 seconds

OPERATION	OBJECT_NAME	CARDINALITY	COST
SELECT STATEMENT			31
PX COORDINATOR			
PX SEND (QC (ORDER))	:TQ10005	3000	31
SORT (GROUP BY)		3000	31
PX RECEIVE		3000	31
PX SEND (RANGE)	:TQ10004	3000	31
HASH (GROUP BY)		3000	31
HASH JOIN		3000	30

INDEXING - BITMAP

- After

Script Output | Autotrace | Query Result

SQL | Fetched 50 rows in 0.21 seconds

	ACC_NUMBER	ACC_VISITS	FULLNAME	CITY	CC_EXPIRY_DATE
1	91511	9999	TRUE	GLENBURN	28-JAN-19
2	93873	9996	TRUE	LEVERETT	10-FEB-19
3	93294	9994	FALSE	BEDFORD	28-FEB-19
4	92638	9993	TRUE	PITTSFIELD	28-FEB-19

SQL HotSpot | 1.64 seconds

OPERATION	OBJECT_NAME	CARDINALITY	COST
SELECT STATEMENT			21
PX COORDINATOR			
PX SEND (QC (ORDER))	:TQ10005	3000	21
SORT (GROUP BY)		3000	21
PX RECEIVE		3000	21
PX SEND (RANGE)	:TQ10004	3000	21
HASH (GROUP BY)		3000	21
HASH JOIN		3000	20
Access Predicates			
AD.ADDRESS_NUMBER=CC.ADDRESS_NUMBER			
PX RECEIVE		3000	10
PX SEND (HYBRID HASH)	:TQ10002	3000	10

PARALLELISM

- Used to speed up database operation
- Natural fit for relational database environment
- Steps:
  - Run a query

```
select acc_number,acc_password,acc_visits,session_id
from user_account;
```

  - Alter table using parallelism
  - Run the query again and look at the new execution plan

PARALLELISM (Execution Time)

Before

Script Output | Query Result

SQL | Fetched 50 rows in 0.393 seconds

	ACC_NUMBER	ACC_PASSWORD	ACC_VISITS	SESSION_ID
1	92641	F4EN7	5840	80726
2	92642	D1AUa	6079	80727

After

Script Output | Query Result

SQL | Fetched 50 rows in 0.093 seconds

	ACC_NUMBER	ACC_PASSWORD	ACC_VISITS	SESSION_ID
1	92641	F4EN7	5840	80726
2	92642	D1AUa	6079	80727

PARALLELISM (Query Cost)

Before

OPERATION	OBJECT_NAME	CARDINALITY	COST
SELECT STATEMENT		5000	15
TABLE ACCESS (FULL)	USER_ACCOUNT	5000	15
Other XML			
{info}			
info type="db_version"			
12.1.0.2			
info type="parse_schema"			

After

OPERATION	OBJECT_NAME	CARDINALITY	COST
SELECT STATEMENT		5000	4
PX COORDINATOR			
PX SEND (QC (RANDOM))	:TQ10000	5000	4
PX BLOCK (ITERATOR)		5000	4
TABLE ACCESS (FULL)	USER_ACCOUNT	5000	4
Other XML			
{info}			

DBA SCRIPTS

- DBA scripts are an excellent ways to query data dictionary in order to better understand what’s happening inside the database engine.
- Useful to monitor the database , to ensure the security of database

```
SELECT NVL(s.username, '(oracle)') AS username, s.osuser, s.sid,
p.spid, s.serial#, s.lockwait, s.status, s.service_name,
s.module, s.program,s.machine,
TO_CHAR(s.logon_Time,'DD-MON-YYYY HH24:MI:SS') AS login_time
FROM v$session s,v$process p WHERE s.paddr = p.addr
ORDER BY login_time;
```

DBA SCRIPTS (cont'd)

List of active sessions of the database

Script Output | Explain Plan | Query Result

SQL | All Rows Fetched: 45 in 0.086 seconds

	USERNAME	OSUSER	SID	SPID	SERIAL#	LOCKWAIT	STATUS	SERVICE_NAME	MODULE	PROGRAM	MACHINE	LOGIN_TIME
1	DB212	Lavanya	64	928	7894	(null)	INACTIVE	SYS$USERS	SQL Developer	SQL Developer	BADUGU	18-NOV-2016 12:4
2	DB212	YADAA015	44	3024	11250	(null)	INACTIVE	SYS$USERS	JDBC Thin Client	JDBC Thin Client	W7-PC04PARU	18-NOV-2016 13:2
3	DB212	YADAA015	85	3228	290	(null)	INACTIVE	SYS$USERS	JDBC Thin Client	JDBC Thin Client	W7-PC04PARU	18-NOV-2016 13:2
4	DB212	YADAA015	36	1832	58357	(null)	INACTIVE	SYS$USERS	JDBC Thin Client	JDBC Thin Client	W7-PC04PARU	18-NOV-2016 13:3
5	DB212	YADAA015	51	3800	34051	(null)	INACTIVE	SYS$USERS	JDBC Thin Client	JDBC Thin Client	W7-PC04PARU	18-NOV-2016 13:3
6	DB212	YADAA015	73	2564	18210	(null)	INACTIVE	SYS$USERS	JDBC Thin Client	JDBC Thin Client	W7-PC04PARU	18-NOV-2016 13:4
7	DB212	YADAA015	111	3636	16216	(null)	INACTIVE	SYS$USERS	JDBC Thin Client	JDBC Thin Client	W7-PC04PARU	18-NOV-2016 13:4
8	DB215	Win7	75	1252	37409	(null)	INACTIVE	SYS$USERS	SQL Developer	SQL Developer	Win7-PC	18-NOV-2016 13:5
9	DB215	HP PC	102	1132	36038	(null)	ACTIVE	SYS$USERS	SQL Developer	SQL Developer	HP	18-NOV-2016 14:0
10	DB220	shangruff	78	296	16291	(null)	INACTIVE	SYS$USERS	SQL Developer	SQL Developer	DESKTOP-ERJIK1J	18-NOV-2016 14:0
11	DB212	Guest1	96	3576	39807	(null)	INACTIVE	SYS$USERS	SQL Developer	SQL Developer	DESKTOP-SQIP6IA	18-NOV-2016 14:1
12	DB212	Ajay Kumar	60	3760	59175	(null)	INACTIVE	SYS$USERS	SQL Developer	SQL Developer	AjayKumar-HP	18-NOV-2016 14:2

DATABASE SECURITY

- Prevent unauthorized user actions
- Encryption prevents unauthorized access
- Data access is controlled more
- Security given to users based on roles

e.g., A person with role as ‘Administrator’ is only authorized to update all the information from all the tables.

Grant All on USER ACCOUNT for ‘Administrator’;

THANK YOU