

CS 325 Week 2-2

Continue database processing and development

More intro-to-SQL basics

Question

What is the preferred suffix for a SQL script's file name?

- 1) .sql
- 2) .txt
- 3) .exe
- 4) it should have no suffix

Question

Which of the following is a DBMS?

- 1) Excel
- 2) Oracle
- 3) Windows 10
- 4) SQL

Database processing and development

- DBMS Responsibilities: a DBMS, then, manages the database structure, controls access to the data stored in the db, and provides various tools to allow users/application programs to use the data

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- Interacting with a DBMS: Examples include server-side JavaScript, Java servlets, and more.
- DBMS Complexity: Simple DBMS, Multi-User DBMS, Large and Complex DBMS

Question:

What does "database design" focus on in the context of this course?

- 1) How the DBMS itself is built
- 2) How the DBMS manages the internal structure of files
- 3) Deciding which tables to create, their relationships, and what columns they should have
- 4) Designing the user interface for interacting with the database

Database processing and development

- What do we mean (in this course) by database design?
 - it is not how the DBMS is built, nor is it the file details about how the DBMS implements a database;

Database processing and development

- What do we mean (in this course) by database design?
 - it is not how the DBMS is built, nor is it the file details about how the DBMS implements a database;
 - we mean, instead, what tables we choose to create as part of a database? how are they interrelated? what are their columns?
 - this is what I mean, in the DB Reading Packet 1, by "the design of the database structure that will be used to store and manage data"

Database processing and development

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 - With these powerful DBMSs, why do we care about database design?
 - Analogy: Having the most advanced OS, doesn't make you a great programmer

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 - With these powerful DBMSs, why do we care about database design?
 - Analogy: Having the most advanced OS, doesn't make you a great programmer
 - Even with the best DBMS, you can end up with a poorly designed database

Database processing and development

- What do we mean (in this course) by database design?
 - With these powerful DBMSs, why do we care about database design?
 - DBMS makes it easy to make tables? Why do I care what tables I pick, and how I relate them, and what columns I put in them, etc?
 - a wonderful DBMS does not mean that you can't build a database using it that will NOT work well for users and applications...
 - Even a good DBMS will perform poorly with a badly-designed db

A little bit of history about DBMS

- What is a File?
 - A file is commonly seen as a stream of characters or a collection of lines, which persists between programs.

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- Mainframe Era - companies are using mainframes to manage their data through file processing systems
- important LIMITATIONS of file-processing systems as the quantity of data involved increases

A little bit of history about DBMS

- important LIMITATIONS of file-processing systems as the quantity of data involved increases:
 - separated and isolated data
 - It's difficult to manage data when information is stored in separate files.

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 - separated and isolated data
 - It's difficult to manage data when information is stored in separate files.
 - Complex Queries and Inefficient Solutions

A little bit of history about DBMS

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 - (unnecessary) data duplication
 - Data Duplication in Files

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 - Data Duplication in Files
 - Think about university's student records
 - Efficiency and data integrity issues
 - Think about changing student phone number in one file

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- important LIMITATIONS of file-processing systems as the quantity of data involved increases:
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 - difficulty of representing data in the users' perspective

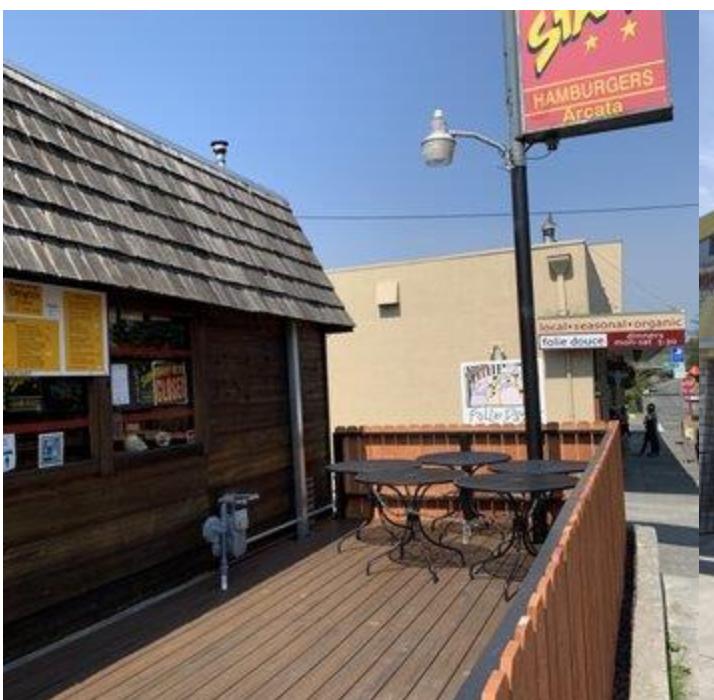
A little bit of history about DBMS

- important LIMITATIONS of file-processing systems as the quantity of data involved increases:
 - separated and isolated data
 - (unnecessary) data duplication
 - application program dependency
 - difficulty of representing data in the users' perspective
 - Think about that user often just want to see a subset of the data

Question

Which of the following can happen because of separated and isolated data as the number of files (and the amount of data stored in those files) increases?

- 1) can make it easier to keep data up to date and consistent
- 2) can have a tendency to increase application program independence
- 3) can make integrating the data more practical
- 4) can make data in different files difficult to relate to each other when needed/desired



Restaurants Example

Stars Hamburgers - Arcata
Taco Bell - McKinleyville
McDonald's - Valley West
Arcata Pizza Deli - Arcata - if get slice-of-pizza special
Philly Cheese Steak Shoppe - Arcata
Hey Juan Burritos - Arcata
Slice of Humboldt Pie - Arcata
Carl's Jr - Valley West
Dutchy's Pizza - Arcata
Wendy's - Eureka
McDonald's - Eureka
Burger King - McKinleyville
Subway - Arcata

have-burgers

Burger King: Arcata, 839-9299
Arcata Pizza & Deli: Arcata, 822-4650
McDonald's: Arcata, 822-0888
Stars Burgers: Eureka, 445-2061
Wendy's: Eureka, 441-4900
The Burger Joint: Arcata, 630-5144
Humboldt Brews: Arcata, 826-2739
Toni's 24 Hr Restaurant: Arcata, 822-0091

cheap-restaurants.txt
have-burgers.docx
pizza-available.ods
sandwich-shops.odt

pizza-available.ods

	A	B	C
1	Mazzotti's	Arcata	773 8th Street
2	Dutchy's	Arcata	1116 11th Street
3	La Trattoria	Arcata	30 Sunnybrae Ctr
4	Arcata Pizza Deli	Arcata	1057 H St
5	Marcelli's	Eureka	1323 5th Street
6	Paul's Live from New York	Arcata	665 Samoa Blvd

sandwich-shops.odt

McDonald's, 822-0888, open 24 hours
Wendy's, 707-441-4900, 10:00 am - 1:00 am every day
Philly Cheese Steak, 825-7400, 11 am - 9 pm daily
Stars Hamburgers, (707) 826-1379, M-Sat 11:00 am to 8:00 pm, Sun noon to 6:00 pm
Subway, 840-9811, don't know
Arcata Pizza Deli, 707 822-4650, 11:00 am - at least 12:00 am (later on some days)
Toni's, 822-0091, 24/7

Restaurants Example

- Categorizing Data in Files
- Challenges with Separated and Isolated Data

Restaurants Example

- Categorizing Data in Files
- Challenges with Separated and Isolated Data
 - Pulling data from multiple files is difficult and time-consuming.

Restaurants Example

- Categorizing Data in Files
- Challenges with Separated and Isolated Data
- Data Duplication Issues

Restaurants Example

- Categorizing Data in Files
- Challenges with Separated and Isolated Data
- Data Duplication Issues
- The Bigger Picture
 - Files aren't inherently bad, but as data grows, managing it becomes harder.
 - Manually checking data isn't feasible with hundreds of rows.
 - This is why people seek alternatives to files.

A little bit of history about DBMS

- important LIMITATIONS of file-processing systems as the quantity of data involved increases:
 - separated and isolated data
 - (unnecessary) data duplication
 - application program dependency
 - difficulty of representing data in the users' perspective
- these helped fuel a desire for something better!...database processing systems;
- seeking to IMPROVE on the situation, at least potentially

A little bit of history about DBMS

- seeking to IMPROVE on the situation, at least potentially
 - potential for more-integrated data

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 - Think about Object-Oriented Programming or when you call a sorting method

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- seeking to IMPROVE on the situation, at least potentially
 - potential for more-integrated data
 - potential for less unnecessary data duplication
 - potential for decreased application program dependency
 - Think about Object-Oriented Programming or when you call a sorting method
 - SQL allows you to write queries that often remain unchanged even if the DBMS changes.

A little bit of history about DBMS

- seeking to IMPROVE on the situation, at least potentially
 - potential for more-integrated data
 - potential for less unnecessary data duplication
 - potential for decreased application program dependency
 - potential for easier representation of the user's perspectives

Question:

How does a well-designed database help minimize data duplication?

- 1) It stores every detail in every table to ensure completeness.
- 2) It keeps duplication to a minimum by only repeating data necessary to link tables together.
- 3) It completely eliminates the need to store any duplicate data.
- 4) It duplicates all data to ensure faster access.

A little bit of history about DBMS

- seeking to IMPROVE on the situation, at least potentially
 - potential for more-integrated data
 - potential for less unnecessary data duplication
 - potential for decreased application program dependency
 - potential for easier representation of the user's perspectives
- database system
 - Centralized Data Storage
 - No Need for Manual Consolidation

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- seeking to IMPROVE on the situation, at least potentially
 - potential for more-integrated data
 - potential for less unnecessary data duplication
 - potential for decreased application program dependency
 - potential for easier representation of the user's perspectives
- database system
 - Centralized Data Storage
 - No Need for Manual Consolidation
 - Minimal Data Duplication

```
-- quickie table(s) for in-class restaurant example

-- (warning: for this example, I didn't really MODEL this
-- scenario properly!!)

drop table restaurant cascade constraints;

create table restaurant
(rest_id      integer,
 rest_name    varchar2(50),
 rest_str_addr  varchar2(50),
 rest_city    varchar2(30),
 rest_phone   varchar2(12),
 has_pizza    char(1) check(has_pizza in ('y', 'n')),
 has_burgers   char(1) check(has_burgers in ('y', 'n')),
 has_sandwiches  char(1) check(has_sandwiches in ('y', 'n')),
 primary key   (rest_id)
);

drop table rest_menu_faves cascade constraints;

create table rest_menu_faves
(rest_id      integer,
 menu_item    varchar2(100),
 menu_item_cost decimal(5, 2),
 primary key (rest_id, menu_item),
 foreign key (rest_id) references restaurant
);
```

```
insert into restaurant
values
(1, 'Stars Hamburgers', '1535 G St', 'Arcata', '707-826-1379', 'n', 'y', 'y');

insert into restaurant
values
(2, 'Taco Bell', '1811 Central Ave', 'Mckinleyville', '707-839-7734',
 'n', 'n', 'n');

insert into restaurant
values
(3, 'McDonald''s', '4901 Valley West Blvd', 'Arcata', '707-822-0888',
 'n', 'y', 'y');

insert into restaurant
values
(4, 'Arcata Pizza Deli', '1057 H St', 'Arcata', '707-822-4650', 'y', 'y', 'y');

insert into restaurant
values
(5, 'Philly Cheese Steak Shoppe', '1811 G St', 'Arcata', '707-825-7400',
 'n', 'n', 'y');

insert into restaurant
values
(6, 'Hey Juan Burritos', '1642 1/2 G St', 'Arcata', '707-822-8433', 'n',
 'n', 'n');

insert into restaurant
values
(7, 'Slice of Humboldt Pie', '828 I St', 'Arcata', '707-630-5100', 'n',
 'n', 'n');
```

```
column rest_name format a20 tru          -- addresses of burger places?
column rest_str_addr format a15 tru

-- which restaurants serve burgers AND pizza?
prompt Restaurants that serve burgers AND pizza:
prompt =====

select rest_name
from restaurant
where has_pizza = 'y'
|     and has_burgers = 'y';

-- phone numbers of restaurants that serve pizza?
prompt phone numbers of restaurants that serve pizza:
prompt =====

select rest_name, rest_phone
from restaurant
where has_pizza = 'y';

-- addresses of burger places?
prompt addresses of burger places:
prompt =====

select rest_name, rest_str_addr, rest_city
from restaurant
where has_burgers = 'y';

-- restaurants in Eureka that serve sandwiches?
prompt restaurants in Eureka that serve sandwiches
prompt =====

select rest_name, rest_city
from restaurant
where rest_city = 'Eureka'
|     and has_sandwiches = 'y';
```

A little bit of history about DBMS

- obviously, a database-processing approach CAN have disadvantages, also;
 - DBMSs are complex and can require a lot of memory.

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- obviously, a database-processing approach CAN have disadvantages, also;
 - DBMSs are complex and can require a lot of memory.
 - Costs can be high, both for the DBMS itself and for converting data.
 - Performance may not always be better than file-based systems, especially for highly optimized custom applications.

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- obviously, a database-processing approach CAN have disadvantages, also;
 - DBMSs are complex and can require a lot of memory.
 - Costs can be high, both for the DBMS itself and for converting data.
 - Performance may not always be better than file-based systems, especially for highly optimized custom applications.
 - When streaming large amounts of data, DBMS overhead can slow down processing.
 - Centralized data introduces the risk of a single point of failure, requiring careful attention to backups and security.

Question

Which of the following should have the least unnecessary data duplication?

- 1) a spreadsheet system
- 2) a file-processing system
- 3) a database processing system
- 4) a rolodex system

MORE intro to SQL and SQL*Plus

- SQL*Plus command: prompt
 - just prints a message to the screen (or, say, to spooled output)
 - JUST follow the command with the desired message (!)
 - if you follow it with nothing? You get a blank line to the screen...!

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prompt

prompt Howdy there CS 325

prompt

```
[● ● ●] dl313 ~ ssh dl313@nrs-projects-ssh.humboldt.edu 80x24
[[dl313@nrs-projects ~]$ mkdir f24-325lect02-2
[dl313@nrs-projects ~]$ ]
```

```
[● ● ●] dl313 ~ ssh dl313@nrs-projects-ssh.humboldt.edu 80x24
[dl313@nrs-projects ~]$ mkdir f24-325lect02-2
[dl313@nrs-projects ~]$ chmod 700 f24-325lect02-2
[dl313@nrs-projects ~]$ 
```

```
[● ● ●] dl313 ~] $ mkdir f24-325lect02-2  
[dl313 ~] $ chmod 700 f24-325lect02-2  
[dl313 ~] $ cd f24-325lect02-2  
[dl313 f24-325lect02-2]$
```

```
[● ● ●] dl313 ~] $ mkdir f24-325lect02-2  
[dl313 ~] $ chmod 700 f24-325lect02-2  
[dl313 ~] $ cd f24-325lect02-2  
[dl313 f24-325lect02-2] $ vim 325lect02-2.sql
```

1, 22

A11

```
di313 — di313@nrs-projects:~/f24-325lect02-2 — ssh di313@nrs-projects-ssh.humboldt.edu — 80x24
-- demo of the prompt

prompt
prompt Howdy there CS 325
prompt []
~  
~  
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~  
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~  
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~  
~  
~  
-- INSERT --
```

5,7

All



di313 — di313@nrs-projects:~/f24-325lect02-2 — ssh di313@nrs-projects-ssh.humboldt.edu — 80x24

-- demo of the prompt

prompt

prompt Howdy there CS 325

prompt

~

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~

:wq

```
[d1313@nrs-projects ~]$ mkdir f24-325lect02-2
[d1313@nrs-projects ~]$ chmod 700 f24-325lect02-2
[d1313@nrs-projects ~]$ cd f24-325lect02-2
[d1313@nrs-projects f24-325lect02-2]$ vim 325lect02-2.sql
[d1313@nrs-projects f24-325lect02-2]$ sqlplus /  
  
SQL*Plus: Release 19.0.0.0.0 - Production on Wed Sep 4 07:42:05 2024
Version 19.3.0.0.0  
  
Copyright (c) 1982, 2019, Oracle. All rights reserved.  
  
Last Successful login time: Fri Aug 30 2024 09:34:02 -07:00  
  
Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0  
  
SQL> □
```

```
[d1313@nrs-projects ~]$ mkdir f24-325lect02-2
[d1313@nrs-projects ~]$ chmod 700 f24-325lect02-2
[d1313@nrs-projects ~]$ cd f24-325lect02-2
[d1313@nrs-projects f24-325lect02-2]$ vim 325lect02-2.sql
[d1313@nrs-projects f24-325lect02-2]$ sqlplus /

SQL*Plus: Release 19.0.0.0.0 - Production on Wed Sep 4 07:42:05 2024
Version 19.3.0.0.0

Copyright (c) 1982, 2019, Oracle. All rights reserved.

Last Successful login time: Fri Aug 30 2024 09:34:02 -07:00

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0

SQL> start 325lect02-2.sql
Howdy there CS 325
SQL>
```

```
[dl313@nrs-projects f24-325lect02-2]$ [dl313@nrs-projects ~]$ sqlplus /  
SQL*Plus: Release 19.0.0.0.0 - Production on Wed Sep 4 07:55:42 2024  
Version 19.3.0.0.0  
  
Copyright (c) 1982, 2019, Oracle. All rights reserved.  
  
Last Successful login time: Wed Sep 04 2024 07:55:23 -07:00  
  
Connected to:  
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production  
Version 19.3.0.0.0  
  
SQL>
```

MORE intro to SQL and SQL*Plus

- SQL*Plus command: prompt
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- SQL*Plus command: / command
 - if you have, in SQL*Plus, a command that is just: “/”
... this redoes the previous SQL statement



di313 — di313@nrs-projects:~/f24-325lect02-2 — ssh di313@nrs-projects-ssh.humboldt.edu — 80x24

[di313@nrs-projects f24-325lect02-2]\$ vim 325lect02-2.sql]


```
dl313 - dl313@nrs-projects:~/f24-325lect02-2 - ssh dl313@nrs-projects-ssh.humboldt.edu - 80x24
[[dl313@nrs-projects ~]$ cd f24-325lect02-2/
[[dl313@nrs-projects f24-325lect02-2]$ sqlplus /
SQL*Plus: Release 19.0.0.0.0 - Production on Wed Sep 4 08:18:40 2024
Version 19.3.0.0.0
Copyright (c) 1982, 2019, Oracle. All rights reserved.

Last Successful login time: Wed Sep 04 2024 07:55:42 -07:00

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.3.0.0.0
[SQL> start 325lect02-2.sql
Howdy there CS 325
STUDENT_ID STUDENT_NAME          STUDENT_SHIRTCOLOR
----- -----
313 Dongcheng Li                black
SQL> ]
```



```
dl313 — dl313@nrs-projects:~/f24-325lect02-2 — ssh dl313@nrs-projects-ssh.humboldt.edu — 80x24
```

```
Copyright (c) 1982, 2019, Oracle. All rights reserved.
```

```
Last Successful login time: Wed Sep 04 2024 08:18:40 -07:00
```

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production  
Version 19.3.0.0.0
```

```
|SQL> start 325lect02-2.sql
```

```
Howdy there CS 325
```

STUDENT_ID	STUDENT_NAME	STUDENT_SHIRTCOLOR
313	Dongcheng Li	black

STUDENT_ID	STUDENT_NAME	STUDENT_SHIRTCOLOR
313	Dongcheng Li	black

```
SQL> 
```

```
di313 — di313@nrs-projects:~/f24-325lect02-2 — ssh di313@nrs-projects-ssh.humboldt.edu — 80x24
-- demo of the prompt

prompt
prompt Howdy there CS 325
prompt

-- reminder: this version of a select statement displays
-- all the rows and all the columns of the named table

select *
from student;

prompt demo forward slash
-- and typing a forward slash redoes the previous SQL statement;

/
~
~
~
~
~
~

-- INSERT --
```

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
-----
          313 Dongcheng Li      black
STUDENT_ID STUDENT_NAME      STUDENT_SHIRTCOLOR
-----
          313 Dongcheng Li      black
SQL> start 325lect02-2.sql
]
Howdy there CS 325

STUDENT_ID STUDENT_NAME      STUDENT_SHIRTCOLOR
-----
          313 Dongcheng Li      black
demo forward slash

STUDENT_ID STUDENT_NAME      STUDENT_SHIRTCOLOR
-----
          313 Dongcheng Li      black
SQL> □
```

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- SQL*Plus command: / command
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... this redoes the previous SQL statement
- more discussion of a FEW more column types (we'll call these column DOMAINS or attribute DOMAINS next week...) available in SQL

MORE intro to SQL and SQL*Plus

- more discussion of a FEW more column types (we'll call these column DOMAINS or attribute DOMAINS next week...) available in SQL
- basic SQL create table statement syntax:

```
create table new_table_name
(col_name col_type any_additional_constraints,
 col_name col_type any_additional_constraints,
 ...
 primary key (col_name, col_name, ...),
 foreign key (col_name) references another_table
);
```

MORE intro to SQL and SQL*Plus

- more discussion of a FEW more column types (we'll call these column DOMAINS or attribute DOMAINS next week...) available in SQL
- basic SQL create table statement syntax.
- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - varchar2(n) - a varying-length character string up to n characters long

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - varchar2(n) - a varying-length character string up to n characters long
 - char(n) - a fixed-length character string of EXACTLY n characters
 - yes this PADS on the right with blanks if you try to store a value in such a column with fewer than n characters!
 - (style!) ONLY use for TRULY fixed-length-strings!

MORE intro to SQL and SQL*Plus

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 - varchar2(n) - a varying-length character string up to n characters long
 - char(n) - a fixed-length character string of EXACTLY n characters
 - yes this PADS on the right with blanks if you try to store a value in such a column with fewer than n characters!
 - (style!) ONLY use for TRULY fixed-length-strings!
 - REMEMBER: in SQL, a string literal is surrounded by SINGLE QUOTES!!! (at least in column values...!)

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 - varchar2(n) - a varying-length character string up to n characters long
 - char(n) - a fixed-length character string of EXACTLY n characters
 - yes this PADS on the right with blanks if you try to store a value in such a column with fewer than n characters!
 - (style!) ONLY use for TRULY fixed-length-strings!
 - REMEMBER: in SQL, a string literal is surrounded by SINGLE QUOTES!!! (at least in column values...!)
 - date - a true date type! even includes time!
 - we'll talk about lovely date-related functions later
 - in the meantime, here's the default way of typing a date literal when used in an insert statement:

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - we'll talk about lovely date-related functions later
 - in the meantime, here's the default way of typing a date literal when used in an insert statement:

'DD-Mon-YYYY' or 'DD-Mon-YY'

'31-Aug-2021' or '31-Aug-21'

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - we'll talk about lovely date-related functions later
 - in the meantime, here's the default way of typing a date literal when used in an insert statement:
 - fun fact: Oracle SQL also has a lovely no-argument function sysdate, that returns the current date...!

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - decimal(p, q) - a decimal number of up to p total places, up to q of which are fractional
 - decimal(5, 2) - can hold values of up to 5 total places, 2 of which are fractional -- up to 999.99

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - decimal(p, q) - a decimal number of up to p total places, up to q of which are fractional
 - integer - an integer in the range -2,147,482,648 to 2,147,483,647

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - decimal(p, q) - a decimal number of up to p total places, up to q of which are fractional
 - integer - an integer in the range -2,147,482,648 to 2,147,483,647
 - don't try to specify the number of digits for an integer, Oracle SQL does not support that;

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - decimal(p, q) - a decimal number of up to p total places, up to q of which are fractional
 - integer - an integer in the range -2,147,482,648 to 2,147,483,647
 - smallint - an integer in the range -32,768 to 32,767

MORE intro to SQL and SQL*Plus

- here are a FEW of the more-common data types that the Oracle DBMS supports for columns in its implementation of SQL:
 - date - a true date type! even includes time!
 - decimal(p, q) - a decimal number of up to p total places, up to q of which are fractional
 - integer - an integer in the range -2,147,482,648 to 2,147,483,647
 - smallint - an integer in the range -32,768 to 32,767
 - want to play it safe?
 - number - can store fixed and floating point numbers, virtually any magnitude, are guaranteed portable among different system running Oracle, up to 38 digits of precision...!

MORE intro to SQL and SQL*Plus

- A few starting word about PRIMARY keys
 - COURSE STYLE - every table should have an explicitly-defined primary key
 - a primary key is a SET of one or more columns whose values UNIQUELY determine a row in a table (no two rows can have the same value(s) for that set of columns!)
 - many/most DBMS's will ENFORCE this, and refuse to allow a row to be inserted that has the same primary key values as an existing row!

Question:

What is the primary purpose of a foreign key in a CREATE TABLE statement?

- 1) To uniquely identify each row in the table
- 2) To establish a relationship between a column in one table and a column in another table
- 3) To execute the previous SQL command
- 4) To display a message on the screen

MORE intro to SQL and SQL*Plus

- A few starting words about FOREIGN keys
 - these are what we use to RELATE the values in one table to the values in another table -- why we can say a database is made up of INTERRELATED tables
 - a foreign key is a set of one or more columns that are in another table, and the intent is that those columns in that table and those in this table have the same "meaning"

```
foreign key(col_name, ...) references desired_table
```

...that means the columns (col_name, ...) in this table
reference those in desired_table

```
foreign key(col_name, ...) references desired_table(col_name, ...)
```

...use this form if the referenced column has a different name
(but make sure the contents have the same MEANING...)

MORE intro to SQL and SQL*Plus

- A few starting words about FOREIGN keys
 - these are what we use to RELATE the values in one table to the values in another table -- why we can say a database is made up of INTERRELATED tables
 - a foreign key is a set of one or more columns that are in another table, and the intent is that those columns in that table and those in this table have the same "meaning"
 - IMPORTANT Oracle DBMS note: the foreign key column(s) MUST be the primary key of the referenced table...
 - NOW a proper DBMS will CHECK and make SURE a row being added to a table with a foreign key has a value for the foreign key column or columns that MATCH at least one row in the referenced table;
 - once you have foreign keys, you can't drop a referenced table if another table references it -- UNLESS your drop table statement ends in ... cascade constraints;

```
-- and typing a forward slash redoes the previous SQL statement;  
/  
-- playing with some of the column types discussed today  
  
drop table parts cascade constraints;  
  
create table parts  
(part_num          integer,  
 part_name         varchar2(25),  
 quantity_on_hand smallint,  
 price             decimal(6, 2), -- max price allowed is 9999.99  
 level_code        char(3),      -- Must be exactly 3 characters  
 last_inspected   date,  
 primary key       (part_num)  
);
```



-- INSERT --

36,1

Bot

```
di313 ~ di313@nrs-projects:~/f24-325lect02-2 ssh di313@nrs-projects-ssh.humboldt.edu 80x24
 313 Dongcheng Li      black

|SQL> start 325lect02-2.sql

Howdy there CS 325

STUDENT_ID STUDENT_NAME          STUDENT_SHIRTCOLOR
----- -----
 313  Dongcheng Li            black

demo forward slash

STUDENT_ID STUDENT_NAME          STUDENT_SHIRTCOLOR
----- -----
 313  Dongcheng Li            black

Table dropped.

Table created.

SQL> 
```

MORE intro to SQL and SQL*Plus

- **IMPORTANT NOTE!**
 - do NOT put a blank line *within* a SQL statement!!!
 - (please put them BETWEEN SQL statements, but not WITHIN them)
 - sqlplus treats a blank line as if you are ending the current SQL statement...!

MORE intro to SQL and SQL*Plus

- SQL*Plus command: describe
 - use to describe the basic structure of the specified table
 - `describe desired_table_name`

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24

create table parts
(part_num          integer,
 part_name        varchar2(25),
 quantity_on_hand smallint,
 price            decimal(6, 2),    -- max price allowed is 9999.99
 level_code       char(3),        -- Must be exactly 3 characters
 last_inspected   date,
 primary key      (part_num)
);

drop table part_orders cascade constraints;

create table part_orders
(order_num         char(6),
 cust_num         char(8),
 part_num         integer,
 order_date       date,
 primary key      (order_num),
 foreign key      (part_num) references parts
);
```

-- INSERT --

42,3

Bot

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
);

drop table part_orders cascade constraints;

create table part_orders
(order_num      char(6),
 cust_num      char(8),
 part_num      integer,
 order_date    date,
 primary key   (order_num),
 foreign key   (part_num) references parts
);

prompt *** describe parts: ***
describe parts

prompt *** describe part_orders: ***
describe part_orders
```

-- INSERT --

50,21

Bot

```
Table dropped.
```

```
Table created.
```

```
*** describe parts: ***
```

Name	Null?	Type
PART_NUM	NOT NULL	NUMBER(38)
PART_NAME		VARCHAR2(25)
QUANTITY_ON_HAND		NUMBER(38)
PRICE		NUMBER(6,2)
LEVEL_CODE		CHAR(3)
LAST_INSPECTED		DATE

```
*** describe part_orders: ***
```

Name	Null?	Type
ORDER_NUM	NOT NULL	CHAR(6)
CUST_NUM		CHAR(8)
PART_NUM		NUMBER(38)
ORDER_DATE		DATE

```
SQL> 
```

MORE intro to SQL and SQL*Plus

- SQL*Plus command: describe
 - use to describe the basic structure of the specified table
 - `describe desired_table_name`
- SQL insert command
 - you can only insert one row per insert command
 - basic SQL insert syntax #1:
 - you MUST give a value for every column, in the order the columns appear in the create table statement

```
insert into desired_table
values
(col1_val, col2_val, ...);
```

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
cust_num      char(8),
part_num       integer,
order_date     date,
primary key    (order_num),
foreign key    (part_num) references parts
);

prompt *** describe parts: ***
describe parts

prompt *** describe part_orders: ***
describe part_orders

-- let's add a few parts

insert into parts
values
(10603, 'wrench', 13, 9.99, 'XXX', '15-Aug-2023');

"325lect02-2.sql" 59L, 1166C written
```

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
```

```
Table created.
```

```
*** describe parts: ***
```

Name	Null?	Type
PART_NUM	NOT NULL	NUMBER(38)
PART_NAME		VARCHAR2(25)
QUANTITY_ON_HAND		NUMBER(38)
PRICE		NUMBER(6,2)
LEVEL_CODE		CHAR(3)
LAST_INSPECTED		DATE

```
*** describe part_orders: ***
```

Name	Null?	Type
ORDER_NUM	NOT NULL	CHAR(6)
CUST_NUM		CHAR(8)
PART_NUM		NUMBER(38)
ORDER_DATE		DATE

```
1 row created.
```

```
SQL> □
```

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
QUANTITY_ON_HAND          NUMBER(38)
PRICE                      NUMBER(6,2)
LEVEL_CODE                 CHAR(3)
LAST_INSPECTED             DATE

*** describe part_orders: ***
Name           Null?    Type
-----
ORDER_NUM      NOT NULL CHAR(6)
CUST_NUM       CHAR(8)
PART_NUM       NUMBER(38)
ORDER_DATE     DATE

1 row created.

SQL> select *
[ 2 from parts;
]
]

PART_NUM PART_NAME          QUANTITY_ON_HAND    PRICE  LEV  LAST_INSP
-----  -----
10603   wrench                13        9.99  XXX  15-AUG-23

SQL>
```

MORE intro to SQL and SQL*Plus

- SQL insert command
 - you can only insert one row per insert command
 - basic SQL insert syntax #2:
 - you don't have to give a value of every column!
 - (any you don't specify will be considered NULL, the special thing meaning empty, lack of a value! unless you specified a default value...)
 - you need to specify the columns you ARE setting values to, and then give the values in that order:

```
insert into desired_table(first_col_to_set, second_col_to_set, ...)
values
(first_col_to_set_val, second_col_to_set_val, ...);
```

```
prompt *** describe parts: ***  
  
describe parts  
  
prompt *** describe part_orders: ***  
  
describe part_orders  
  
-- let's add a few parts  
  
insert into parts  
values  
(10603, 'wrench', 13, 9.99, 'XXX', '15-Aug-2023');  
  
insert into parts(price, part_num)  
values  
(876.54, 10607);  
  
select *  
from parts;□  
  
-- INSERT --
```

63,12

Bot

```
di313 ~ f24-325lect02-2 ssh di313@nrs-projects-ssh.humboldt.edu 80x24
LEVEL_CODE          CHAR(3)
LAST_INSPECTED      DATE

*** describe part_orders: ***
Name           Null?    Type
-----          -----   -----
ORDER_NUM       NOT NULL CHAR(6)
CUST_NUM        CHAR(8)
PART_NUM        NUMBER(38)
ORDER_DATE      DATE

1 row created.

1 row created.

PART_NUM PART_NAME          QUANTITY_ON_HAND     PRICE  LEV LAST_INSP
-----  -----          -----          -----   -----  -----
10603  wrench                13            9.99  XXX 15-AUG-23
10607                      876.54

SQL> 
```

MORE intro to SQL and SQL*Plus

- a FEW additional CONSTRAINTS, or limitations, you can make when you declare a column in a table
 - not null
 - you want this column to ALWAYS have a value -- don't let it be null (don't let it be empty)

```
create table blah
(
    ...
    maxpoints    integer not null,
```

MORE intro to SQL and SQL*Plus

- a FEW additional CONSTRAINTS, or limitations, you can make when you declare a column in a table
 - Unique
 - you want a (non-primary-key) attribute to also be unique, not-repeated in any other row

MORE intro to SQL and SQL*Plus

- a FEW additional CONSTRAINTS, or limitations, you can make when you declare a column in a table
 - default desired_def_val
 - if a row is inserted that does not explicitly specify a value for this column, make that column have value desired_def_value

```
create table blah
(
    ...
    quantity    integer default 1,
```

MORE intro to SQL and SQL*Plus

- a FEW additional CONSTRAINTS, or limitations, you can make when you declare a column in a table
 - check clause
 - check(boolean_expr)
 - only allow a value in this column for which boolean_expr is true

```
create table blah
(
  ...
  opening_bid decimal(4, 2) check(opening_bid > 0 AND opening_bid < 50),
```

MORE intro to SQL and SQL*Plus

- a FEW additional CONSTRAINTS, or limitations, you can make when you declare a column in a table
 - Oracle SQL supports an IN operator!
 - val IN set ...is true if val is a member of set

```
create table blah
(
    ...
    car_color varchar2(5) check(car_color IN ('red', 'green',
'white')),
```

MORE intro to SQL and SQL*Plus

- a FEW additional CONSTRAINTS, or limitations, you can make when you declare a column in a table
 - Oracle SQL supports a BETWEEN operator!
 - val1 BETWEEN val2 AND val3 ...is true if val1 >= val2 and val1 <= val3

```
create table blah
(
    ...
    quiz_grade decimal(5, 2) check(quiz_grade between 0.00 and
100.00),
```

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
-- playing with some of the column types discussed today

drop table parts cascade constraints;

create table parts
(part_num          integer,
 part_name        varchar2(25) unique not null, []
 quantity_on_hand smallint,
 price            decimal(6, 2),    -- max price allowed is 9999.99
 level_code       char(3),        -- Must be exactly 3 characters
 last_inspected   date,
 primary key      (part_num)
);

drop table part_orders cascade constraints;

create table part_orders
(order_num         char(6),
 cust_num         char(8),
 part_num         integer,
 order_date       date,
 primary key      (order_num),
 foreign key      (part_num) references parts
-- INSERT --
```

```
di313 - di313@nrs-projects:~/f24-325lect02-2 - ssh di313@nrs-projects-ssh.humboldt.edu - 80x24
drop table parts cascade constraints;

create table parts
(part_num          integer,
 part_name        varchar2(25) unique not null,
 quantity_on_hand smallint,
 price            decimal(6, 2),    -- max price allowed is 9999.99
 level_code       char(3),        -- Must be exactly 3 characters
 last_inspected   date,
 primary key      (part_num)
);

drop table part_orders cascade constraints;

create table part_orders
(order_num         char(6),
 cust_num         char(8) not null,
 part_num         integer not null,
 order_date       date,
 quantity         integer default 1 not null,
 order_code       char(1) check(order_code in ('B', 'I', 'G')),
 delivery_code    char(1) check(delivery_code in ('U', 'F', 'P')) not null,
 primary key      (order_num),
-- INSERT --
```

```
prompt *** describe parts: ***  
  
describe parts  
  
prompt *** describe part_orders: ***  
  
describe part_orders  
  
-- let's add a few parts  
  
insert into parts  
values  
(10603, 'wrench', 13, 9.99, 'XXX', '15-Aug-2023');  
  
-- we made part_name not null, but we are trying to insert a row with part_name  
as null, lets run and see what will happen  
  
insert into parts(price, part_num)  
values  
(876.54, 10607);  
  
select *  
-- INSERT --
```

61,123 93%

```
di313 — di313@nrs-projects:~/f24-325lect02-2 — ssh di313@nrs-projects-ssh.humboldt.edu — 80x24
```

ORDER_NUM	NOT NULL	CHAR(6)
CUST_NUM	NOT NULL	CHAR(8)
PART_NUM	NOT NULL	NUMBER(38)
ORDER_DATE		DATE
QUANTITY	NOT NULL	NUMBER(38)
ORDER_CODE		CHAR(1)
DELIVERY_CODE	NOT NULL	CHAR(1)

1 row created.

```
insert into parts(price, part_num)
*
ERROR at line 1:
ORA-01400: cannot insert NULL into ("DL313"."PARTS"."PART_NAME")
```

PART_NUM	PART_NAME	QUANTITY_ON_HAND	PRICE	LEV	LAST_INSP
10603	wrench	13	9.99	XXX	15-AUG-23

SQL> □

```
prompt *** describe parts: ***
describe parts

prompt *** describe part_orders: ***
describe part_orders

-- let's add a few parts

insert into parts
values
(10603, 'wrench', 13, 9.99, 'XXX', '15-Aug-2023');

insert into parts(price, part_name, part_num)
values
(876.54, 'bubble gum', 10607);

select *
from parts;

"325lect02-2.sql" 68L, 1479C written
```

63,30

Bot

```
di313 — di313@nrs-projects:~/f24-325lect02-2 — ssh di313@nrs-projects-ssh.humboldt.edu — 80x24
```

```
*** describe part_orders: ***
```

Name	Null?	Type
ORDER_NUM	NOT NULL	CHAR(6)
CUST_NUM	NOT NULL	CHAR(8)
PART_NUM	NOT NULL	NUMBER(38)
ORDER_DATE		DATE
QUANTITY	NOT NULL	NUMBER(38)
ORDER_CODE		CHAR(1)
DELIVERY_CODE	NOT NULL	CHAR(1)

```
1 row created.
```

```
1 row created.
```

PART_NUM	PART_NAME	QUANTITY_ON_HAND	PRICE	LEV	LAST_INSP
10603	wrench	13	9.99	XXX	15-AUG-23
10607	bubble gum		876.54		

```
SQL> □
```