Recitation -2-

Structured Query Language
SQL - DDL

- SQL Datatypes
- DDL statements

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Basic SQL-DDL COMMANDS

- For database schemas:
  CREATE SCHEMA, DROP SCHEMA
- For tables:
  CREATE TABLE, DROP TABLE, ALTER TABLE
- For views:
  CREATE VIEW, DROP VIEW
- For integrity constraints
  CREATE IC, DROP IC
- For domains:
  CREATE DOMAIN, DROP DOMAIN [SQL99]

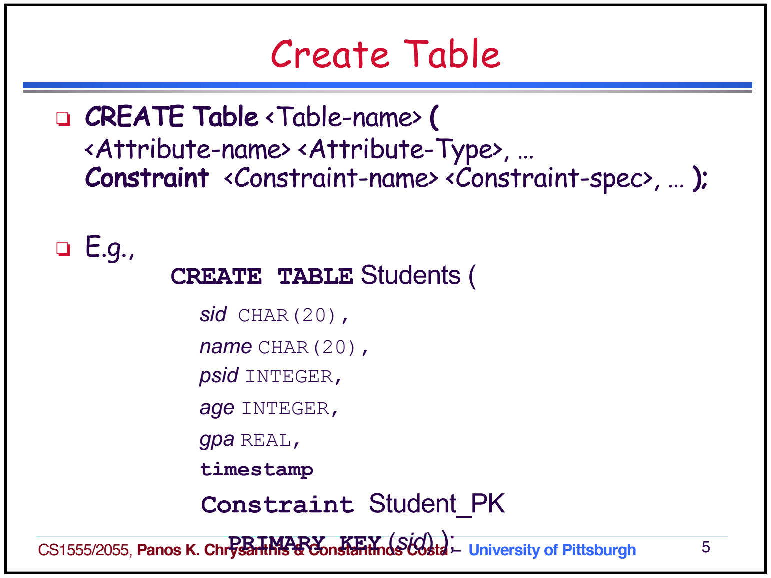
For Indexes [defunct in SQL2]

Database Schema

- CREATE SCHEMA <database-name>
  AUTHORIZATION <user-identifier>;
- E.g. **CREATE SCHEMA** micro_db
  AUTHORIZATION panos;
- DROP SCHEMA <db-name> [RESTRICT | CASCADE];
  - Restrict: removes the schema if the db has no data
  - Cascade: removes everything, data and definitions
- E.g., **DROP SCHEMA** micro_db **RESTRICT**;

Schema and Catalog

- SQL2, SQL3 support multiple database schemas
- **Catalog** contains the definitions of database schemas
- INFORMATION_SCHEMA
  - Schemas and Base relations (tables)
    (tbl_name, creator, #of_tuples, tuple_length, #of_attributes…)
  - Attributes of Relations (columns)
    (tbl_name, atrb_name, type, format, order, key_no, ...)
  - Authorization
  - Integrity
  - Indexes
- Naming of tables: Schema_name.Table_name
- Query: Describe table name; or using SELECT



Create Table

- **CREATE Table** <Table-name> **(**
  <Attribute-name> <Attribute-Type>, …
  Constraint <Constraint-name> <Constraint-spec>, … **);**

- E.g.,

```
CREATE TABLE Students (
    sid CHAR(20),
    name CHAR(20),
    psid INTEGER,
    age INTEGER,
    gpa REAL,
    timestamp
    Constraint Student_PK
      PRIMARY KEY (sid) );
```

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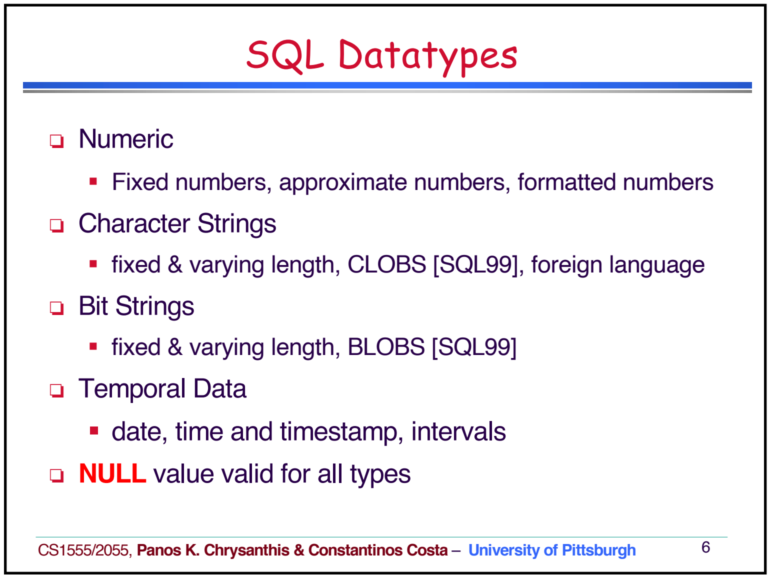

SQL Datatypes

- Numeric
  - Fixed numbers, approximate numbers, formatted numbers
- Character Strings
  - fixed & varying length, CLOBS [SQL99], foreign language
- Bit Strings
  - fixed & varying length, BLOBS [SQL99]
- Temporal Data
  - date, time and timestamp, intervals
- **NULL** value valid for all types

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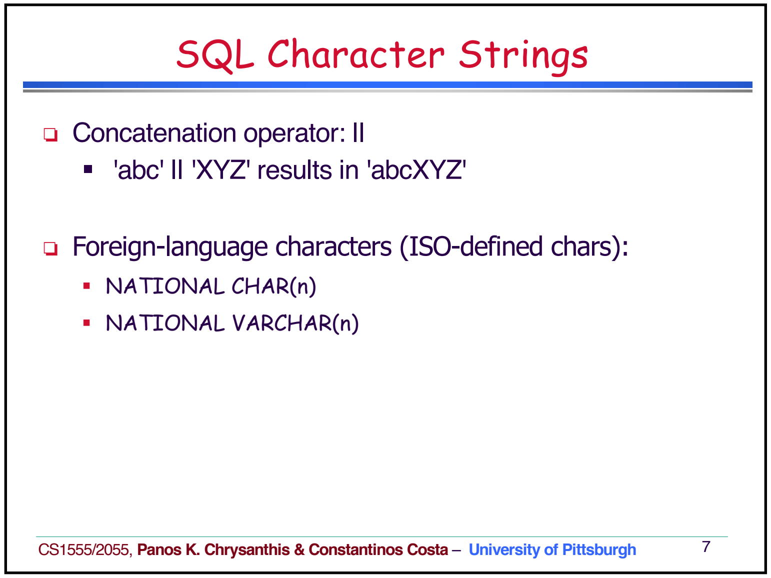

SQL Character Strings

- Concatenation operator: ll
  - 'abc' ll 'XYZ' results in 'abcXYZ'

- Foreign-language characters (ISO-defined chars):
  - NATIONAL CHAR(n)
  - NATIONAL VARCHAR(n)

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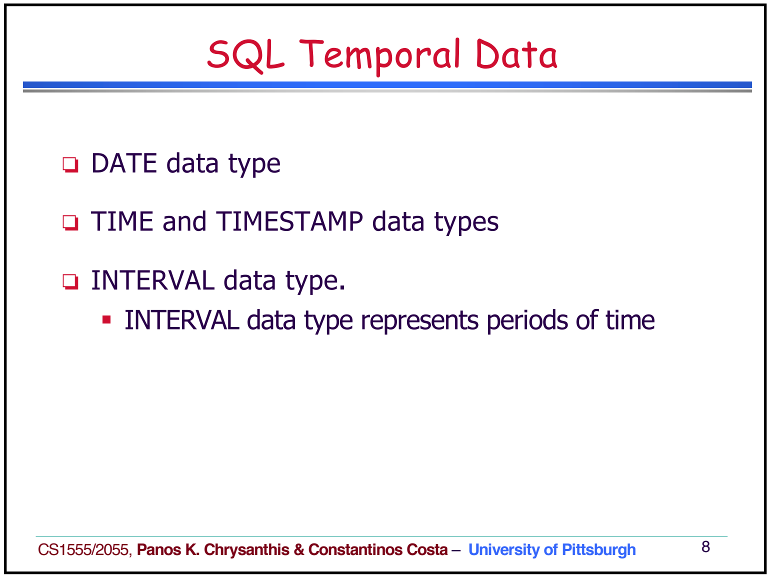

SQL Temporal Data

- DATE data type

- TIME and TIMESTAMP data types

- INTERVAL data type.
  - INTERVAL data type represents periods of time

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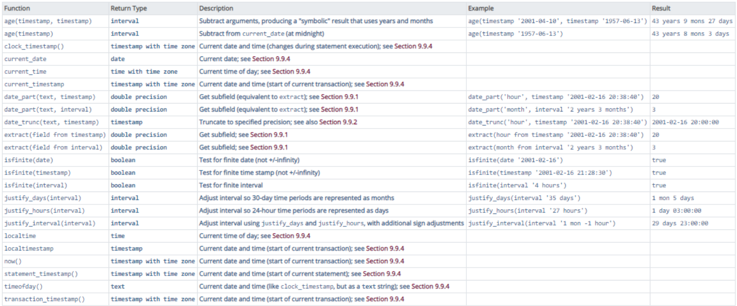
Date and Time

- DATE (10 positions) stores calendar values representing YEAR, MONTH, and DAY: **YYYY-MM-DD**
- TIME defines HOURS, MINUTES, and SECONDS in a twenty-four-hour notation: **HH:MM:SS**
- TIME(i) defines *i* additional decimal fractions of seconds: **HH:MM:SS:ddd...d**
- TIME WITH TIME ZONE includes the displacement [+13:00 to -12:59] from standard universal time zone: **HH:MM:SS{+/-}hh:mm**
  - *hh* are the two digits for the TIMEZONE_HOUR and *mm* the two digits for TIMEZONE_MINUTE
- TIMESTAMP represents a complete date and time with 6 fractions of seconds and optional time zone.

Functions on Dates

- All systems provide functions under different names
  - for constructing a date from strings or integers
  - for extracting out the month, day, or year from a date
  - for displaying dates in different ways
- Examples,
  - CAST(string AS DATE) [SQL2: CAST(<value> AS <type>)]
    e.g., CAST('2002-02-18' AS DATE)
  - MAKEDATE (int year, int month, int day) or
    DATE (int year, int month, int day)
    e.g., MAKEDATE(1999, 12, 31)
  - EXTRACT (MONTH/DAY/YEAR FROM <date>) [SQL3]
  - YEAR(<date>), MONTH(<date>), DAY(<date>)

PostqreSQL Functions on Dates



Function	Return Type	Description	Example	Result
age(timestamp, timestamp)	interval	Subtract arguments, producing a "symbolic" result that uses years and months	age(timestamp '2001-04-10', timestamp '1957-06-13')	43 years 9 mons 27 days
age(timestamp)	interval	Subtract from current_date (at midnight)	age(timestamp '1957-06-13')	43 years 8 mons 3 days
clock_timestamp()	timestamp with time zone	Current date and time (changes during statement execution); see Section 9.9.4		
current_date	date	Current date; see Section 9.9.4		
current_time	time with time zone	Current time of day; see Section 9.9.4		
current_timestamp	timestamp with time zone	Current date and time (start of current transaction); see Section 9.9.4		
date_part(text, timestamp)	double precision	Get subfield (equivalent to extract); see Section 9.9.1	date_part('hour', timestamp '2001-02-16 20:38:40')	20
date_part(text, interval)	double precision	Get subfield (equivalent to extract); see Section 9.9.1	date_part('month', interval '2 years 3 months')	3
date_trunc(text, timestamp)	timestamp	Truncate to specified precision; see also Section 9.9.2	date_trunc('hour', timestamp '2001-02-16 20:38:40')	2001-02-16 20:00:00
extract(field from timestamp)	double precision	Get subfield; see Section 9.9.1	extract(hour from timestamp '2001-02-16 20:38:40')	20
extract(field from interval)	double precision	Get subfield; see Section 9.9.1	extract(month from interval '2 years 3 months')	3
isfinite(date)	boolean	Test for finite date (not +/-infinity)	isfinite(date '2001-02-16')	true
isfinite(timestamp)	boolean	Test for finite time stamp (not +/-infinity)	isfinite(timestamp '2001-02-16 21:28:30')	true
isfinite(interval)	boolean	Test for finite interval	isfinite(interval '4 hours')	true
justify_days(interval)	interval	Adjust interval so 30-day time periods are represented as months	justify_days(interval '35 days')	1 mon 5 days
justify_hours(interval)	interval	Adjust interval so 24-hour time periods are represented as days	justify_hours(interval '27 hours')	1 day 03:00:00
justify_interval(interval)	interval	Adjust interval using justify_days and justify_hours, with additional sign adjustments	justify_interval(interval '1 mon -1 hour')	29 days 23:00:00
localtime	time	Current time of day; see Section 9.9.4		
localtimestamp	timestamp	Current date and time (start of current transaction); see Section 9.9.4		
now()	timestamp with time zone	Current date and time (start of current transaction); see Section 9.9.4		
statement_timestamp()	timestamp with time zone	Current date and time (start of current statement); see Section 9.9.4		
timeofday()	text	Current date and time (like clock_timestamp, but as a text string); see Section 9.9.4		
transaction_timestamp()	timestamp with time zone	Current date and time (start of current transaction); see Section 9.9.4		

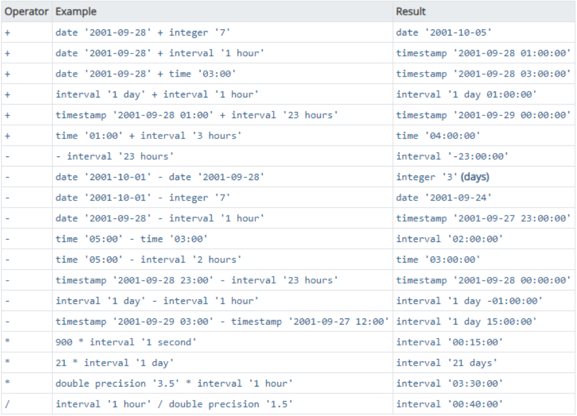
Operations on Dates

- Datetime (+ or -) Interval = Datetime
- Datetime - Datetime = Interval
- Interval (* or /) Number = Interval
- Interval (+ or -) Interval = Interval
- Examples (ANSI SQL):
  - (CURRENT_DATE + INTERVAL '1' MONTH)
  - (CURRENT_DATE - INTERVAL '18' DAY)
  - (CURRENT_DATE – BirthDate)

Intervals

- An interval results when two dates are subtracted. E.g., AdmitDate – DischargeDate
- Two interval data types: **Year-Month** & **Day-Time**
- Format: INTERVAL start-field(p) [TO end-field(fs)]
  - p is the precision (default is 2 digits)
  - fs is the fractional second precision, which is only applicable to DAY/TIME (default is 6 digits)
- Year-Month intervals:
  - INTERVAL YEAR, INTERVAL YEAR(p), INTERVAL MONTH, INTERVAL MONTH(p), INTERVAL YEAR TO MONTH, INTERVAL YEAR(p) TO MONTH
  - E.g., INTERVAL YEAR (2) to MONTH could be [0-0, 99-11]

PostqreSQL Intervals…



Operator	Example	Result
+	date '2001-09-28' + integer '7'	date '2001-10-05'
+	date '2001-09-28' + interval '1 hour'	timestamp '2001-09-28 01:00:00'
+	date '2001-09-28' + time '03:00'	timestamp '2001-09-28 03:00:00'
+	interval '1 day' + interval '1 hour'	interval '1 day 01:00:00'
+	timestamp '2001-09-28 01:00' + interval '23 hours'	timestamp '2001-09-29 00:00:00'
+	time '01:00' + interval '3 hours'	time '04:00:00'
-	- interval '23 hours'	interval '-23:00:00'
-	date '2001-10-01' - date '2001-09-28'	integer '3' (days)
-	date '2001-10-01' - integer '7'	date '2001-09-24'
-	date '2001-09-28' - interval '1 hour'	timestamp '2001-09-27 23:00:00'
-	time '05:00' - time '03:00'	interval '02:00:00'
-	time '05:00' - interval '2 hours'	time '03:00:00'
-	timestamp '2001-09-28 23:00' - interval '23 hours'	timestamp '2001-09-28 00:00:00'
-	interval '1 day' - interval '1 hour'	interval '1 day -01:00:00'
-	timestamp '2001-09-29 03:00' - timestamp '2001-09-27 12:00'	interval '1 day 15:00:00'
*	900 * interval '1 second'	interval '00:15:00'
*	21 * interval '1 day'	interval '21 days'
*	double precision '3.5' * interval '1 hour'	interval '03:30:00'
/	interval '1 hour' / double precision '1.5'	interval '00:40:00'