

דוגמה לבניית טבלה בבסיס נתונים שהגדרנו קודם, בשם database1 :

```
USE database1;

CREATE TABLE Person
(
personID int NOT NULL,
lastName varchar(30) NOT NULL,
firstName varchar(25) NOT NULL
)

ON [ filegroup ];
```

דוגמה לשינוי הטבלה הנ"ל והוספת עמודה:

```
USE database1;
ALTER TABLE Person
ADD Gender char(1) NOT NULL;
```

דוגמה להוספת עמודה מחושבת:

```
USE database1;
ALTER TABLE Person
ADD fullName AS lastName+' ', '+firstName;
```

הוספת אילוץ כדוגמת מפתח ראשי על עמודה מסוימת (יכולנו, אגב, להגדיר את המפתח בבניה המקורית עם ה-CREATE):

```
USE database1;
ALTER TABLE Person
ADD CONSTRAINT PK_PersonID
PRIMARY KEY (personID);
```

עוד אילוץ של מפתח זר. במידה ויש לנו טבלה נוספת של כתובות בשם: Address

```
USE database1;

ALTER TABLE Address
ADD CONSTRAINT FK_Person_To_Address_On_personID
FOREIGN KEY (personID)
REFERENCES Person(personID);
```

באופן כללי יש לזכור שמערכת אילוצים שאנו כופים על בסיס הנתונים מיועדת ע"מ לשמור על אמינות של הנתונים, או מה שנקרא באופן כללי: Data Integrity  
ישנו אילוץ שיכול קצת לבלבל, זהו אילוץ שניקרא: UNIQUE  
ניתן להוסיף אילוץ זה על כל עמודה שרוצים (עדיף על פי הגיון), כך שבסיס הנתונים לא ירשה הכנסת שורות עם אותו ערך בעמודה זו. זה מבלבל כי העמודה אינה חייבת להיות מפתח ראשי. מפתח ראשי גם הוא ייחודי, אבל לא צריך לציין לגביו: UNIQUE

טיפוסי נתונים  
אנחנו נדון בעיקר בטיפוסי כמו: int (שלמים), char (תוים בגודל קבוע), varchar (תוים באורך משתנה)

ישנם עוד הרבה מאד טיפוסי נתונים ויתכן שנזכיר עוד במשך הלימודים ואולי גם נשתמש באחרים, אולם הסוגים המצויינים הנ"ל יספיקו בעיקרון לרוב הדיונים והתרגילים שעליהם נעבוד.

דוגמה להכנסת נתונים לטבלה:

```
INSERT INTO Person
(
  personID, lastName, firstName
)
VALUES
(274, 'Kidman', 'Nicole'),
(275, 'Einstein', 'Albert'),
(276, 'Cohen', 'Yossi')
```

עבודה על הטבלאות שמוזכרות ב: All\_Tables.pdf

זוהי מערכת טבלאות (בסיס נתונים) שבעזרתה ניתן לנהל ספריית סטודנטים ונשתמש בה כדי לתרגל כל מיני שאילתות (בעיקר פעולות של SELECT)

תאור הנתונים וחלוקתם לטבלאות:

1. Library - טבלה זו מכילה את שם הספרייה ואת העיר בה היא ממוקמת (Lname, City)
2. Book - טבלה זו מכילה נתונים עבור ספרים, מספר זיהוי ספר (ISBN), שם (Title) ושם מחבר (Author)
3. Available - טבלה שמכילה את הספרים הזמינים בכל רגע נתון באיזו מן הספריות הקיימות. העמודות הן זיהוי ספר, שם ספרייה ומספר עותקים של הספר בספרייה שבשורה.
4. Borrow - טבלה שבה נימצאים מספרי הזיהוי של הסטודנטים (ID), שם ספרייה ממנה הושאל הספר (Lname) וזיהוי ספר (ISBN).
5. Student - טבלה שמכילה את כל הסטודנטים, מספר זיהוי סטודנט או סטודנטית, שם ועיר שבה הסטודנט או הסטודנטית גרים.

בניית הטבלאות (קודם הריסה למקרה שכבר קיימות)

```
DROP TABLE Borrow;  
DROP TABLE Available;  
DROP TABLE Book;  
DROP TABLE Library;  
DROP TABLE Student;
```

כעת בניית הטבלאות

```
CREATE TABLE Student (  
  ID      VarChar(15) Primary Key,  
  SName  VarChar(30),  
  SCity  VarChar(30)  
);
```

```
CREATE TABLE Book (  
  ISBN   VarChar(15) Primary Key,  
  Title  VarChar (30) NOT NULL,  
  Author VarChar (30)  
);
```

```
CREATE TABLE Library (  
  LName  VarChar(30) Primary Key,  
  City   VarChar(30) NOT NULL  
);
```

```
CREATE Table Available (  
  ISBN      VarChar(15),  
  LName     VarChar(30),  
  noOfCopies Integer NOT NULL,  
  Primary Key (ISBN, LName),  
  Foreign Key (ISBN) References Book(ISBN),  
  Foreign Key (LName) References  
  Library(LName)  
);
```

```
CREATE TABLE Borrow (  
  ID VarChar(15),  
  LName VarChar(30),  
  ISBN  VarChar(15),  
  Primary Key (ID, LName, ISBN),  
  Foreign Key(ID) References Student(ID),  
  Foreign Key (LName, ISBN) References Available(LName, ISBN)  
);
```

ולבסוף הכנסת הנתונים עימם נעבוד (כדאי ואפילו מומלץ להכניסם על ידי משפטי ה-SQL  
הבאים ולא ידנית)

```
INSERT INTO Book (ISBN, Title, Author) VALUES ('1878351001', 'Filippo Lippi', 'Gloria Fossi');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0521830842', 'Foundations of Cryptography', 'Oded Goldreich');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0471751561', 'Linear Algebra', 'Peter Lax');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0824774566', 'Abstract Algebra', 'Gary Crown');
INSERT INTO Book (ISBN, Title, Author) VALUES ('052188473X', 'Computational Complexity', 'Oded Goldreich');
INSERT INTO Book (ISBN, Title, Author) VALUES ('9889950316', 'Trivial Matters', 'Ho-Cheung Pang');
INSERT INTO Book (ISBN, Title, Author) VALUES ('1596912839', 'The Brain', 'Sam Wang');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0195145704', 'Biggest Bang', 'Jonathan Katz');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0000025127', 'Lust, Caution', 'Ailing Zhang');
INSERT INTO Book (ISBN, Title, Author) VALUES ('1843834227', 'The Spy From the Co-op', 'David Burke');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0521035368', 'Foundations of Cryptography', 'Oded Goldreich');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0972169520', 'Piled Higher and Deeper', 'Jorge Cham');
INSERT INTO Book (ISBN, Title, Author) VALUES ('174104779X', 'Chile and Easter Island', 'Carolyn McCarthy');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0007162219', 'The Big Bang Theory', 'Simon Singh');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0312425074', 'The World is Flat', 'Thomas L. Friedman');
INSERT INTO Book (ISBN, Title, Author) VALUES ('9621747082', 'Monopoly', 'Hon Yuen Ng');
INSERT INTO Book (ISBN, Title, Author) VALUES ('1571310487', 'Cracking India', 'Bapsi Sidhwa');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0471556041', 'Functional Analysis', 'Peter Lax');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0452010926', 'Gay American History', 'Jonathan Katz');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0061234001', 'Freakonomics', 'Steven D. Levitt');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0140367152', 'Journey to the Center', 'Jules Verne');
INSERT INTO Book (ISBN, Title, Author) VALUES ('0071497838', 'Essential Phrasal Verbs', 'Richard Spears');
INSERT INTO Book (ISBN, Title, Author) VALUES ('6666666666', 'Terrorism for Dummies', 'Bernard Cushing');
```

```
INSERT INTO Book (ISBN, Title, Author) VALUES ('1586039474', 'Certificateless  
Cryptography', 'Sherman Chow');  
INSERT INTO Book (ISBN, Title, Author) VALUES ('0688146198', 'NLP', 'Steve Andreas');  
INSERT INTO Book (ISBN, Title, Author) VALUES ('7806780769', 'Hong Kong', 'Mong  
Fung Leung');  
INSERT INTO Book (ISBN, Title, Author) VALUES ('0060554738', 'Secret Society', 'Neil  
Strauss');  
INSERT INTO Book (ISBN, Title, Author) VALUES ('0874834430', 'Piled Higher and  
Deeper', 'Simon J. Bronner');  
INSERT INTO Book (ISBN, Title, Author) VALUES ('1400067936', 'Randomness', 'Nassim  
Nicholas Taleb');  
INSERT INTO Book (ISBN, Title, Author) VALUES ('0802134297', 'Candy', 'Terry  
Southern');
```

```
INSERT INTO Library (LName, City) VALUES ('Bobst', 'New York');  
INSERT INTO Library (LName, City) VALUES ('Courant', 'New York');  
INSERT INTO Library (LName, City) VALUES ('Cooper', 'New York');  
INSERT INTO Library (LName, City) VALUES ('Luther', 'Sunnyvale');  
INSERT INTO Library (LName, City) VALUES ('Chinese', 'San Jose');  
INSERT INTO Library (LName, City) VALUES ('Engineering', 'New York');  
INSERT INTO Library (LName, City) VALUES ('Microsoft', 'Remond');  
INSERT INTO Library (LName, City) VALUES ('Central', 'Seattle');  
INSERT INTO Library (LName, City) VALUES ('Aviation', 'Seattle');  
INSERT INTO Library (LName, City) VALUES ('History', 'Dallas');  
INSERT INTO Library (LName, City) VALUES ('Sherman', 'New York');  
INSERT INTO Library (LName, City) VALUES ('Business', 'Denver');  
INSERT INTO Library (LName, City) VALUES ('JFK', 'Newark');  
INSERT INTO Library (LName, City) VALUES ('IBM', 'Zurich');  
INSERT INTO Library (LName, City) VALUES ('Spy', 'DC');  
INSERT INTO Library (LName, City) VALUES ('Main', 'Cambridge');  
INSERT INTO Library (LName, City) VALUES ('Fine Art', 'Boston');  
INSERT INTO Library (LName, City) VALUES ('Othmer', 'New York');  
INSERT INTO Library (LName, City) VALUES ('Law', 'San Jose');  
INSERT INTO Library (LName, City) VALUES ('Star', 'Hollywood');
```

```
INSERT INTO Student (ID, SName, SCity) VALUES ('655', 'Mark Lee', 'Boston');  
INSERT INTO Student (ID, SName, SCity) VALUES ('099', 'John Lee', 'New York');  
INSERT INTO Student (ID, SName, SCity) VALUES ('384', 'Amy Hill', 'Cambridge');  
INSERT INTO Student (ID, SName, SCity) VALUES ('295', 'Jim Cook', 'San Jose');  
INSERT INTO Student (ID, SName, SCity) VALUES ('820', 'Karl Marx', 'Sunnyvale');  
INSERT INTO Student (ID, SName, SCity) VALUES ('341', 'Erin Bell', 'Newark');  
INSERT INTO Student (ID, SName, SCity) VALUES ('937', 'Kyle Ward', 'San Diego');  
INSERT INTO Student (ID, SName, SCity) VALUES ('995', 'Sara Cox', 'Chicago');  
INSERT INTO Student (ID, SName, SCity) VALUES ('735', 'Mark Diaz', '');  
INSERT INTO Student (ID, SName, SCity) VALUES ('710', 'Mary Wood', 'New Haven');  
INSERT INTO Student (ID, SName, SCity) VALUES ('424', 'Lisa Gray', 'Hollywood');  
INSERT INTO Student (ID, SName, SCity) VALUES ('314', 'Sean Cruz', 'Denver');  
INSERT INTO Student (ID, SName, SCity) VALUES ('825', 'Paul Long', 'Las Vegas');  
INSERT INTO Student (ID, SName, SCity) VALUES ('398', 'Eric Yoon', 'New York');  
INSERT INTO Student (ID, SName, SCity) VALUES ('672', 'Tara Lee', 'Boston');  
INSERT INTO Student (ID, SName, SCity) VALUES ('861', 'Sara Lee', 'Dallas');  
INSERT INTO Student (ID, SName, SCity) VALUES ('040', 'Adam Smith', 'Boston');
```

```

INSERT INTO Student (ID, SName, SCity) VALUES ('865', 'Mark Hill', 'New York');
INSERT INTO Student (ID, SName, SCity) VALUES ('646', 'Jane Hall', 'New York');
INSERT INTO Student (ID, SName, SCity) VALUES ('267', 'Rob Gray', 'Cambridge');

INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1878351001', 'Fine Art',
1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0521830842', 'Courant',
1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0471751561', 'Courant',
0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0824774566', 'Cooper', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('052188473X', 'Microsoft',
0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('9889950316', 'Central', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1596912839', 'Sherman',
0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0195145704', 'Luther', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0000025127', 'Chinese',
3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1843834227', 'Spy', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0521035368', 'Sherman',
3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0972169520', 'Star', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('174104779X', 'Star', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0007162219', 'Star', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0312425074', 'Star', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('9621747082', 'Luther', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1571310487', 'Chinese',
2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0471556041', 'IBM', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0452010926', 'History', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0061234001', 'Business',
0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0140367152', 'Main', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0071497838', 'Othmer', 3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('6666666666', 'Spy', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1586039474', 'Courant',
0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0688146198', 'JFK', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('7806780769', 'Bobst', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0060554738', 'Aviation',
3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0874834430', 'Law', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1400067936', 'Law', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0802134297', 'History', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0521830842', 'Bobst', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0471751561', 'Cooper', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0824774566', 'Courant',
0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('052188473X', 'Main', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1586039474', 'Central', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0312425074', 'IBM', 1);

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INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('9621747082', 'Cooper', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('9889950316', 'History', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1596912839', 'Law', 0);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0195145704', 'Law', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0000025127', 'Aviation',
1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1843834227', 'JFK', 4);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0972169520', 'Spy', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('174104779X', 'Othmer',
3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0007162219', 'Main', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0312425074', 'Business',
1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('9621747082', 'History', 4);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1571310487', 'Star', 3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0471556041', 'Chinese',
1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0452010926', 'Central', 3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0061234001', 'Bobst', 3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0140367152', 'Cooper', 2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0071497838', 'Courant',
3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('6666666666', 'Main', 1);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0688146198', 'Microsoft',
2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0060554738', 'Microsoft',
4);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0874834430', 'Fine Art',
2);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('1400067936', 'Fine Art',
3);
INSERT INTO Available (ISBN, LName, noOfCopies) VALUES ('0802134297', 'Fine Art',
4);
```

```
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('865', '0802134297', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('295', '0312425074', 'Star');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('865', '1586039474', 'Central');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('825', '9621747082', 'Cooper');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('295', '1586039474', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('672', '9889950316', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('861', '9621747082', 'Luther');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('735', '0471556041', 'IBM');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('646', '0061234001', 'Business');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('040', '0824774566', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('646', '0874834430', 'Law');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('710', '0521830842', 'Bobst');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('424', '0802134297', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('424', '9889950316', 'Central');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('655', '1596912839', 'Sherman');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('861', '9889950316', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('861', '0824774566', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('099', '0140367152', 'Main');
```

```
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('937', '0874834430', 'Law');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('424', '0521830842', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('995', '0521830842', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('655', '0195145704', 'Luther');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('384', '0000025127', 'Chinese');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('655', '0007162219', 'Star');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('424', '1596912839', 'Law');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('295', '9621747082', 'Cooper');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('099', '1596912839', 'Law');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('820', '0471751561', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('295', '0824774566', 'Cooper');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('099', '9889950316', 'Central');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('295', '1596912839', 'Law');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('937', '0824774566', 'Cooper');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('820', '0312425074', 'Star');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('820', '7806780769', 'Bobst');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('735', '1596912839', 'Law');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('710', '9889950316', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('398', '0521830842', 'Bobst');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('825', '0471751561', 'Cooper');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('314', '0802134297', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('672', '0824774566', 'Courant');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('099', '0824774566', 'Cooper');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('099', '052188473X', 'Microsoft');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('825', '0802134297', 'History');
INSERT INTO Borrow (ID, ISBN, Lname) VALUES ('995', '0471556041', 'IBM');
```