|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| num | lname | fname | dob | ssn | gpa | degree | totcredit | phone | Dept\_code |
| 3231 | Brown | William | 02/11/89 | 123-23-333 | 4.0 | Master | 18 | 4444 | BIO |
| 3232 | Smith | John | 03/31/85 | 213-23-4444 | 3.5 | B.S. | 32 | 4343 | CIS |
| 3333 | Smith | John | 09/10/90 | 415-23-5555 | 3.8 | Master | 18 | 2323 | CS |
| 3334 | Robert | Gerald | 07/07/88 | 51-34-5555 | 3.0 | PhD | 72 | 1111 | ACCT |

**Keys**

Assumptions:

1. **Assume that there are not two person who can have the same (last name, first name, date of birth, phone number).**
2. **Every student num only refers to one student.**
3. **Every ssn only refers to one person.**

Samples of Keys:

|  |  |
| --- | --- |
| num | Identify student all attributes, such as last name, first name, etc |
| ssn | Identify student all attributes, such as last name, first name, etc |
| degree | Identify total credits a student should earn |
| (num, dob) | Identify student all attributes, such as last name, first name, etc |

Samples of Composite Keys:

|  |  |
| --- | --- |
| (num,dob) | Identify student all attributes, such as last name, first name, etc |
| (ssn,num) | Identify student all attributes, such as last name, first name, etc |
| (degree,dept\_code) | Identify total credits a student should earn |

Samples of Superkeys:

|  |  |
| --- | --- |
| num | Uniquely identify any row |
| ssn | Uniquely identify any row |
| (num, dob) | Uniquely identify any row |
| (num,ssn,dob) | Uniquely identify any row |
| (lname,fname,dob,phone) | Uniquely identify any row |

Samples of Candidate keys:

|  |  |
| --- | --- |
| num | yes |
| ssn | yes |
| (num, dob) | no |
| (num,ssn,dob) | no |
| (lname,fname,dob,phone) | yes |

**Relationships between different keys**

**Keys**

|  |  |
| --- | --- |
| **Superkey** | An attribute or a group of attributes that uniquely identifies each row in a table |
| **Candidate key** | A minimal (irreducible) superkey |
| **Primary key** | A candidate key promoted to uniquely identify all other attribute values in any given row. Cannot contain NULL. |
| **Composite key** | An attribute or a group of attributes that can determine the values of the another one or several attributes. Don’t need to uniquely identify each row in a table. |
| **Foreign key** | An attribute or a group of attributes in one table whose values must either match the primary key in another table or be null |

**Normalization**

each attribute must hold a single, atomic value

- Atomic values only

All Non-key attributes are fully functionally dependent on the primary key

**Unnormalized Tables**

**1 Normal Form**

**2 Normal Form**

No transitive dependency between nonkey attributes

All determinants are candidate keys - Single multivalued dependency

**3 Normal Form**

**Boyce-Codd and Higher**