**UNNORAMALIZED**

transcript = (student\_id, firstname, lastname, program\_number, program\_name, {course\_number, course\_title, grade}, crc\_score)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| student\_id | firstname | lastname | program\_number | program\_name |  | crc\_score |
| 1 | Steph | Moreau | Abc | Alphabeth | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 99 | Database | 99.9 | | 88 | Programming | 98.9 | | 77 | Design | 97.5 | | 26 |
| 2 | John | Johnston | Xyz | Numbers | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 99 | Database | 94 | | 66 | Drawing | 97 | | 23 |

**1NF – single value, uniquely identify a row, non-divisible**

transcript = (student\_id, firstname, lastname, program\_number, program\_name, course\_number, course\_title, grade, crc\_score)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **student\_id** | firstname | lastname | program\_number | program\_name | **course\_number** | course\_title | grade | crc\_score |
| 1 | Steph | Moreau | Abc | Alphabeth | 99 | Database | 99.9 | 26 |
| 1 | Steph | Moreau | Abc | Alphabeth | 88 | Programming | 98.9 | 26 |
| 1 | Steph | Moreau | Abc | Alphabeth | 77 | Design | 97.5 | 26 |
| 2 | John | Johnston | Xyz | Numbers | 99 | Database | 94 | 23 |
| 2 | John | Johnston | Xyz | Numbers | 66 | Drawing | 97 | 23 |

**2NF – must be in 1NF, remove partical dependencies (partial dependencies = must relate to PK)**

students = (student\_id, firstname, lastname, program\_number, program\_name, crc\_score)

courses = (course\_number, course\_title)

student\_courses = (student\_id, course\_numer, grade)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **student\_id** | firstname | lastname | program\_number | program\_name | crc\_score |
| 1 | Steph | Moreau | Abc | Alphabeth | 26 |
| 2 | John | Johnston | Xyz | Numbers | 23 |

|  |  |
| --- | --- |
| **course\_number** | course\_title |
| 99 | Database |
| 88 | Programming |
| 77 | Design |
| 66 | Drawing |

|  |  |  |
| --- | --- | --- |
| **student\_id** | **course\_number** | grade |
| 1 | 99 | 99.9 |
| 1 | 88 | 98.9 |
| 1 | 77 | 97.5 |
| 2 | 99 | 94 |
| 2 | 66 | 97 |

**3NF – must be in 2NF, remove all transitive dependencies (its value does not depend on a non-PK)**

students = (student\_id, firstname, lastname, *program\_id*, crc\_score)

courses = (course\_number, course\_title)

student\_courses = (*student\_id*, *course\_numer*, grade)

program = (program\_id, program\_number, program\_name)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **student\_id** | firstname | lastname | program\_id | crc\_score |
| 1 | Steph | Moreau | 1 | 26 |
| 2 | John | Johnston | 2 | 23 |

|  |  |
| --- | --- |
| **course\_number** | course\_title |
| 99 | Database |
| 88 | Programming |
| 77 | Design |
| 66 | Drawing |

|  |  |  |
| --- | --- | --- |
| **student\_id** | **course\_number** | grade |
| 1 | 99 | 99.9 |
| 1 | 88 | 98.9 |
| 1 | 77 | 97.5 |
| 2 | 99 | 94 |
| 2 | 66 | 97 |

|  |  |  |
| --- | --- | --- |
| program\_id | program\_number | program\_name |
| 1 | Abc | Alphabeth |
| 2 | Xyz | Numbers |

**UNNORAMALIZED**

transcript = (student\_id, firstname, lastname, {program\_number, program\_name, {course\_number, course\_title, grade}}, crc\_score)

added {} to have multiple courses/program

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| student\_id | firstname | lastname | program\_number | program\_name |  | crc\_score |
| 1 | Steph | Moreau | FSD | Full-Stack | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 1 | Foundations | 99.9 | | 2 | Programming | 98.9 | | 3 | Database | 97.5 | | 26 |
|  |  |  | ENG | English | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 7 | English 101 | 99.9 | |  |
| 2 | John | Johnston | FSD | Full-Stack | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 3 | Database | 94 | | 2 | Programmig | 97 | | 23 |
| 3 | Pete | Smith | GWD | Graphics Web Design | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 4 | Drawing | 94 | | 5 | Photoshop | 97 | | 23 |
|  |  |  | ENG | English | |  |  |  | | --- | --- | --- | | course\_number | course\_title | grade | | 7 | English 101 | 99.9 | |  |

1NF

transcript = (student\_id, firstname, lastname, program\_number, program\_name, course\_number, course\_title, grade, crc\_score)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **student\_id** | firstname | lastname | program\_number | program\_name | **course\_number** | course\_title | grade | crc\_score |
| 1 | Steph | Moreau | FSD | Full-Stack | 1 | Foundations | 99.9 | 26 |
| 1 | Steph | Moreau | FSD | Full-Stack | 2 | Programming | 98.9 | 26 |
| 1 | Steph | Moreau | FSD | Full-Stack | 3 | Database | 97.5 | 26 |
| 1 | Steph | Moreau | ENG | English | 7 | English 101 | 99.9 | 23 |
| 2 | John | Johnston | Xyz | Numbers | 66 | Drawing | 97 | 23 |

**UNNORAMALIZED**

transcript = (student\_id, firstname, lastname, program\_number, program\_name, {course\_number, course\_title, program\_number, program\_name, grade}, crc\_score)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| student\_id | firstname | lastname | program\_number | program\_name |  | crc\_score |
| 1 | Steph | Moreau | FSD | Full-Stack | |  |  |  |  |  | | --- | --- | --- | --- | --- | | course\_number | course\_title | program\_number | program\_name | grade | | 1 | Foundations | FSD | Full-Stack | 99.9 | | 2 | Programming | GWD | Graphics Web Design | 98.9 | | 3 | Database | FSD | Full-Stack | 97.5 | | 26 |
| 2 | John | Johnston | FSD | Full-Stack | |  |  |  |  |  | | --- | --- | --- | --- | --- | | course\_number | course\_title | program\_number | program\_name | grade | | 3 | Database | FSD | Full-Stack | 94 | | 2 | Programmig | GWD | Graphics Web Design | 97 | | 23 |
| 3 | Pete | Smith | GWD | Graphics Web Design | |  |  |  |  |  | | --- | --- | --- | --- | --- | | course\_number | course\_title | program\_number | program\_name | grade | | 4 | Drawing | FSD | Full-Stack | 94 | | 5 | Photoshop | GWD | Graphics Web Design | 97 | | 23 |