# Online Education Platform database design- Entity Relationship Diagrams

Nikhil Bharadwaj Narayanam

## Relational schemas: -

USERS (**USER_ID,** USER_NAME, USER_FNAME, USER_LNAME, EMAIL_ID, PASSWORD, USER_DOB, PHN_NO, USER_LOCATION, USER_CATEGORY, USER_DESCRIPTION, CAREER_GOAL)

EMPLOYEE (**USER_ID**, JOB_TITLE, JOB_INDUSTRY, EMPLOYER, TOTAL_EXP)

STUDENT (**USER_ID**, UNIVERSITY_ID, STUDENT_MAJOR, STUDENT_GRAD_STDATE STUDENT_GRADEND, STUDENT_GPA)

INSTRUCTOR (**USER_ID**, INST_NAME, UNIVERSITY_ID, INST_MAILID, INST_EXP, INST_RT)

UNIVERSITY (**UNIVERSITY_ID**, UNIVERSITY_NAME, UNIVERSITY_QSRANKING, UNIVERSITY_LOGO, UNIVERSITY_COUNTRY, UNIVERSITY_STATE, UNIVERSITY_CITY UNIVERSITY_TYPE)

COURSES (**COURSE_ID, USER_ID**, COURSE_STDATE, ENROLLMENT_ENDATE, COURSE_DURATION COURSE_PRICE, COURSE_DESCRIPTION, COURSE_RATING, UNIVERSITY_ID, COURSE_LEVEL, COURSE_PREREQUISITE)

ENROLLS (**USER_ID, COURSE_ID**, ENROLL_DATE, ENROLL_STATUS, ENROLL_GRADE)

CERTIFICATIONS (**CERT_ID**, CERT_NAME, CERT_ISSUE_DATE, CERT_VALID_DATE CERT_GRADE, USER_ID, UNIVERSITY_ID, COURSE_ID)

ASSIGNMENTS (**ASSIGN_ID**, COURSE_ID, ASSIGN_DUEDATE, ASSIGN_MAXG, ASSIGN_DESC, ASSIGN_ATTACH, ASSIGN_FEEDBACK)

ASSIGNMENT_HISTORY (**USER_ID, ASSIGN_ID**, ASSIGN_MARKS, ASSIGN_SUBMIT_DATE)

NOTIFICATIONS (**NOTIF_ID**, NOTIF_CONTENT, NOTIF_TIMESTAMP, NOTIF_TYPE, NOTIF_FLAG)

TARGET_AUDIENCE (**USER_ID, NOTIF_ID**, NOTIF_STATUS)

PAYMENT_DETAILS (**USER_ID**, USER_CARDNUM, USER_CVV, CARD_COUNTRY)

PAYMENT_HISTORY (**PAY_ID**, USER_ID, PAY_DESCRI, PAY_TIMESTAMP, PAY_AMOUNT)

PRIVACY_SETTING (**SETTINGS_ID,** USER_ID, SEND_EMAILS, SHARE_LOCATION, SHARE_DATA)

# Pre-Normalization: -

This table includes information about the users, courses for which they have registered, and the universities that offer the relevant courses. In order to generate distinct instances, the primary keys USER_ID and COURSE_ID are recognized. There is a lot of transitive and partial dependency present here. As can be seen, the USER_ID key determines the value of the attributes USER_NAME, USER_FNAME, USER_LNAME, PHN_NO, and EMAIL_ID, while the COURSE_ID key determines the values of the following attributes: COURSE_NAME, COURSE_STDATE, ENROLLMENT_ENDATE, COURSE_DURATION, COURSE_PRICE, COURSE_RATING, UNIVERSITY_ID, UNIVERSITY_NAME, and UNIVERSITY_QSRANKING. As a result, there are two instances of partial dependency. The transitive dependency within the partial dependency is demonstrated by the fact that UNIVERSITY_ID determines UNIVERSITY_NAME, UNIVERSITY_QSRANKING.

| USER_ID | COURSE_ID | ENROLL_DATE | ENROLL_STATUS | USER_NAME | USER_FNAME | USER_LNAME | PHN_NO | EMAIL_ID | COURSE_NAME | COURSE_STDATE | ENROLLMENT_ENDATE | COURSE_DURATION | COURSE_PRICE | COURSE_RATING | UNIVERSITY_ID | UNIVERSITY_NAME | UNIVERSITY_QSRANKING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 100 | 08/17/2023 | Yet to start | Dark_knight | Bruce | Wayne | 9887634589 | wyane1@gmail.com | Introduction to informatics | 09/17/2023 | 12/16/2023 | 3 months | 280.12 | 2.75 | 10001 | Indiana university indianapolis | 500 |
| 2 | 101 | 01/12/2023 | Completed | Harry_james_potter | Harry | Potter | 7635410951 | potter2@gmail.com | Data mining | 01/08/2023 | 03/07/2023 | 3 months | 360.89 | 3.2 | 10002 | Purdue university | 140 |
| 3 | 102 | 01/09/2024 | In progress | Virat_kohli | Virat | Kohli | 8886878915 | viratkohli18@gmail.com | Software engineering | 12/12/2023 | 04/11/2024 | 4 months | 440.44 | 2.9 | 10003 | University of houston | 600 |
| 4 | 103 | 02/10/2023 | Yet to start | Anumol_bondu | Bondu | Anumol | 9090900000 | bondanumol4@gmail.com | Deep learning | 05/16/2023 | 10/15/2023 | 5 months | 150.98 | 3.6 | 10004 | Rice university | 250 |
| 5 | 104 | 06/05/2023 | Yet to start | James_cameroon | James | Cameroon | 6577654567 | cameroon55@gmail.com | Advance database technologies | 06/06/2023 | 12/05/2023 | 6 months | 270.80 | 3.4 | 10005 | Indiana university bloomington | 280 |
| 6 | 105 | 01/31/2023 | Completed | Ram_charan | Ram | Charan | 9885278915 | ramcharan@gmail.com | Database design | 02/27/2023 | 04/26/2023 | 2 months | 360.42 | 3.7 | 10006 | Arizona state university | 150 |
| 7 | 105 | 01/30/2023 | In progress | Star_lord | Revanth | Posina | 8128038164 | revanthposina@gmail.com | Database design | 02/27/2023 | 04/26/2023 | 2 months | 360.42 | 3.7 | 10006 | Arizona state universities | 150 |
| 3 | 103 | 02/02/2023 | Yet to start | Virat_kohli | Virat | Kohli | 8886878915 | viratkohli18@gmail.com | Deep learning | 05/16/2023 | 10/15/2023 | 5 months | 150.98 | 3.6 | 10004 | Rice university | 250 |
| 7 | 100 | 07/17/2023 | Yet to start | Star_lord | Revanth | Posina | 8128038164 | revanthposina@gmail.com | Introduction to | 09/17/2023 | 12/16/2023 | 3 months | 280.12 | 2.75 | 10001 | Indiana university | 500 |

| | | | | | | | | informatics | | | | | | | | | indianapolis | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## 1NF DEPENDENCY DIAGRAM: -

1NF (**USER_ID, COURSE_ID**, ENROLL_DATE, ENROLL_STATUS, USER_NAME, USER_FNAME, USER_LNAME, PHN_NO, EMAIL_ID, COURSE_NAME, COURSE_STDATE, ENROLLMENT_ENDATE, COURSE_DURATION, COURSE_PRICE, COURSE_DESCRIPTION, COURSE_RATING, UNIVERSITY_ID, UNIVERSITY_NAME, UNIVERSITY_QSRANKING)

## PARTIAL DEPENDECIES

(**USER_ID**, USER_NAME, USER_FNAME, USER_LNAME, PHN_NO, EMAIL_ID)

(**COURSE_ID**, COURSE_NAME, COURSE_STDATE, ENROLLMENT_ENDATE, COURSE_DURATION, COURSE_PRICE, COURSE_RATING, UNIVERSITY_ID, UNIVERSITY_NAME, UNIVERSITY_QSRANKING)

## TRANSITIVE DEPENDENCIES

(**UNIVERSITY_ID**, UNIVERSITY_NAME, UNIVERSITY_QSRANKING)

| USER_ID | COURSE_ID | ENROLL_DATE | ENROLL_STATUS | USER_NAME | USER_FNAME | USER_LNAME | PHN_NO | EMAIL_ID | COURSE_NAME | COURSE_STDATE | ENROLLMENT_ENDATE | COURSE_DURATION | COURSE_PRICE | COURSE_DESCRIPTION | COURSE_RATING | UNIVERSITY_ID | UNIVERSITY_NAME | UNIVERSITY_QSRANKING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## 2NF DEPENDENCY DIAGRAM: -

To apply 2nd Normal Form (2NF), we need to identify the functional dependencies between the columns in the table. In the below tables, the primary keys of ENROLLS are primary keys to the entities USERS and COURSES. This removes the partial dependencies and redundancy by having separate entities for user and course details. On the other hand, we are going to use the bridge table to maintain the (M: N) relationship between the users and courses table which contains the enrollment details. Still, there remains the transitive dependency of (**UNIVERSITY_ID** -> UNIVERSITY_NAME, UNIVERSITY_QSRANKING) which will be normalized as part of 3NF.

| USER_ID | COURSE_ID | ENROLL_DATE | ENROLL_STATUS |
|---------|-----------|-------------|---------------|

(**USER_ID, COURSE_ID**, ENROLL_DATE, ENROLL_STATUS)

| USER_ID | USER_NAME | USER_FNAME | USER_LNAME | PHN_NO | EMAIL_ID |
|---------|-----------|------------|------------|--------|----------|

(**USER_ID**, USER_NAME, USER_FNAME, USER_LNAME, PHN_NO, EMAIL_ID)

| COURSE_ID | COURSE_NAME | COURSE_STDATE | ENROLLMENT_ENDATE | COURSE_DURATION | COURSE_PRICE | COURSE_RATING | UNIVERSITY_ID | UNIVERSITY_NAME | UNIVERSITY_QSRANKING |
|-----------|-------------|---------------|-------------------|-----------------|--------------|---------------|---------------|-----------------|----------------------|

(**COURSE_ID**, COURSE_NAME, COURSE_STDATE, ENROLLMENT_ENDATE, COURSE_DURATION, COURSE_PRICE, COURSE_RATING, UNIVERSITY_ID, UNIVERSITY_NAME, UNIVERSITY_QSRANKING
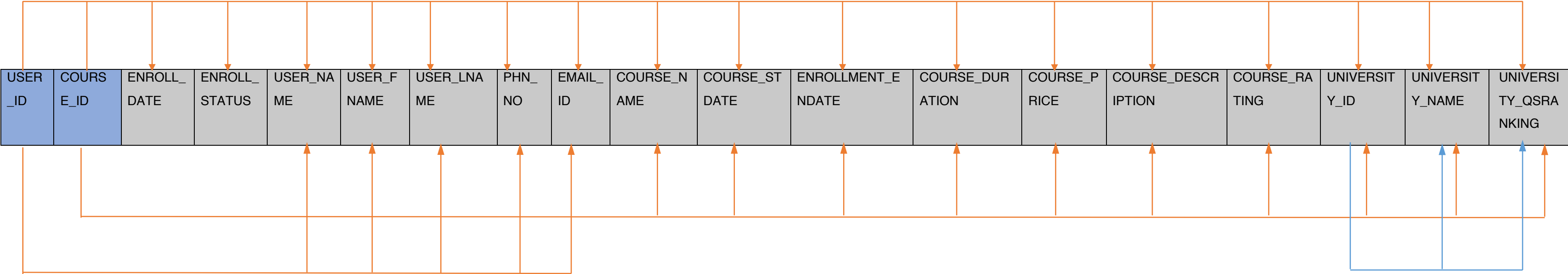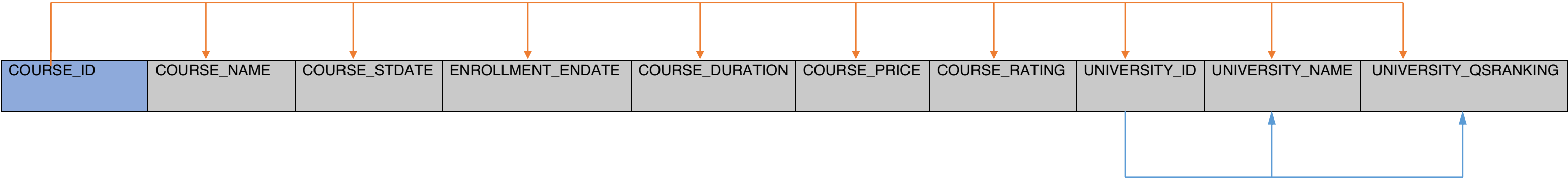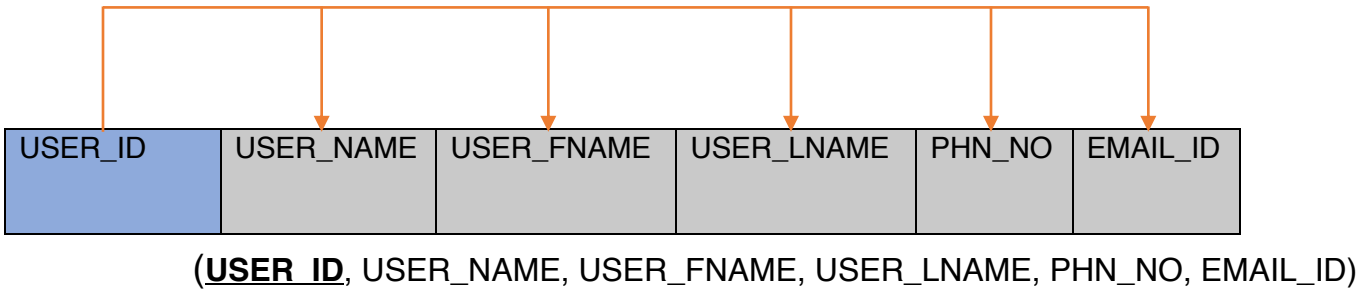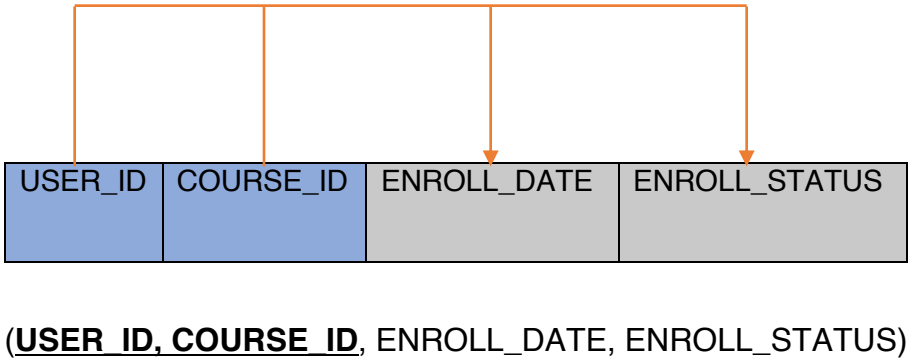
Transitive dependencies: -

(**UNIVERSITY_ID**, UNIVERSITY_NAME, UNIVERSITY_QSRANKING)

## Table : ENROLLS

| USER_ID | COURSE_ID | ENROLL_DATE | ENROLL_STATUS |
|---------|-----------|-------------|---------------|
| 1 | 100 | 08/17/2023 | Yet to start |
| 2 | 101 | 01/12/2023 | Completed |
| 3 | 102 | 01/09/2024 | In progress |
| 4 | 103 | 02/10/2023 | Yet to start |
| 5 | 104 | 06/05/2023 | Yet to start |
| 6 | 105 | 01/31/2023 | Completed |
| 7 | 105 | 01/30/2023 | In progress |
| 3 | 103 | 02/02/2023 | Yet to start |
| 7 | 100 | 07/17/2023 | Yet to start |

## Table : USERS

| USER_ID | USER_NAME | USER_FNAME | USER_LNAME | PHN_NO | EMAIL_ID |
|---------|-----------|------------|------------|--------|----------|
| 1 | Dark_knight | Bruce | Wayne | 9887634589 | wyane1@gmail.com |
| 2 | Harry_james_potter | Harry | Potter | 7635410951 | potter2@gmail.com |
| 3 | Virat_kohli | Virat | Kohli | 8886878915 | viratkohli18@gmail.com |
| 4 | Anumol_bondu | Bondu | Anumol | 9090900000 | bondanumol4@gmail.com |
| 5 | James_cameroon | James | Cameroon | 6577654567 | cameroon55@gmail.com |
| 6 | Ram_charan | Ram | Charan | 9885278915 | ramcharan@gmail.com |
| 7 | Star_lord | Revanth | Posina | 8128038164 | revanthposina@gmail.com |

## Table : COURSES

| COURSE_ID | COURSE_NAME | COURSE_STDATE | ENROLLMENT_ENDATE | COURSE_DURATION | COURSE_PRICE | COURSE_RATING | UNIVERSITY_ID | UNIVERSITY_NAME | UNIVERSITY_QSRANKING |
|-----------|-------------|---------------|-------------------|-----------------|--------------|---------------|---------------|-----------------|----------------------|
| 100 | Introduction to informatics | 09/17/2023 | 12/16/2023 | 3 months | 280.12 | 2.75 | 10001 | Indiana university indianapolis | 500 |

| 101 | Data mining | 01/08/2023 | 03/07/2023 | 3 months | 360.89 | 3.2 | 10002 | Purdue university | 140 |
| 102 | Software engineering | 12/12/2023 | 04/11/2024 | 4 months | 440.44 | 2.9 | 10003 | University of houston | 600 |
| 103 | Deep learning | 05/16/2023 | 10/15/2023 | 5 months | 150.98 | 3.6 | 10004 | Rice university | 250 |
| 104 | Advance database technologies | 06/06/2023 | 12/05/2023 | 6 months | 270.80 | 3.4 | 10005 | Indiana university bloomington | 280 |
| 105 | Database design | 02/27/2023 | 04/26/2023 | 2 months | 360.42 | 3.7 | 10006 | Arizona state university | 150 |

## 3NF and Dependency Diagrams :-

Once the table satisfies all the 2NF rules and every non-prime prime fields are dependent on the primary key or, there are no transitive dependencies for non-prime attributes then the table is in third normal form. In the following table we are going to remove the transitive dependency (**UNIVERSITY_ID**, UNIVERSITY_NAME, UNIVERSITY_QSRANKING) so that all the entities achieve the 3NF which does not have any redundancies.



(**USER_ID, COURSE_ID**, ENROLL_DATE, ENROLL_STATUS)
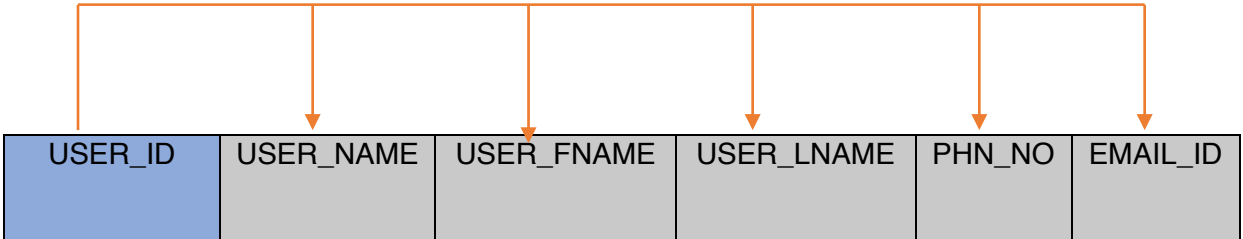


(**USER_ID**, USER_NAME, USER_FNAME, USER_LNAME, PHN_NO, EMAIL_ID)

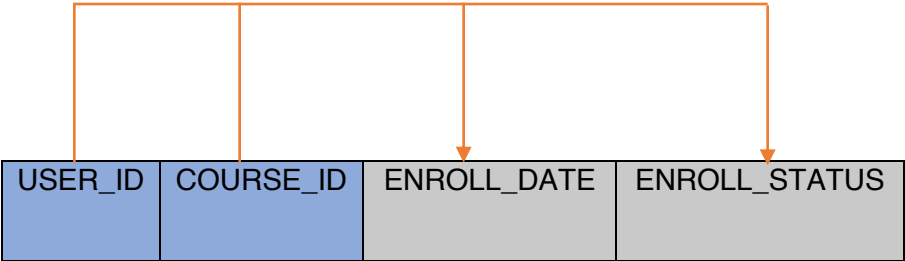| COURSE_ID | COURSE_NAME | COURSE_STDATE | ENROLLMENT_ENDATE | COURSE_DURATION | COURSE_PRICE | COURSE_RATING |
|---|---|---|---|---|---|---|

(**COURSE_ID**, COURSE_NAME, COURSE_STDATE, ENROLLMENT_ENDATE, COURSE_DURATION, COURSE_PRICE, COURSE_RATING, UNIVERSITY_ID, UNIVERSITY_NAME, UNIVERSITY_QSRANKING)
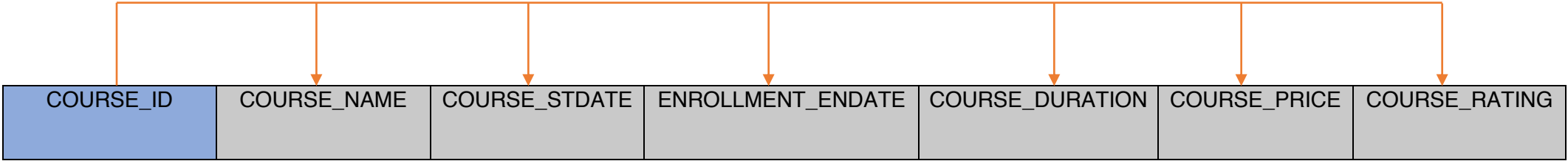
| UNIVERSITY_ID | UNIVERSITY_NAME | UNIVERSITY_QSRANKING |
|---|---|---|
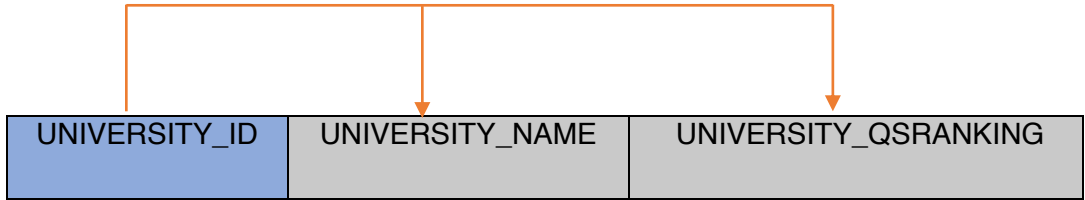
(**UNIVERSITY_ID**, UNIVERSITY_NAME, UNIVERSITY_QSRANKING)

### Table : USERS

| USER_ID | USER_NAME | USER_FNAME | USER_LNAME | PHN_NO | EMAIL_ID |
|---|---|---|---|---|---|
| 1 | Dark_knight | Bruce | Wayne | 9887634589 | wyane1@gmail.com |
| 2 | Harry_james_potter | Harry | Potter | 7635410951 | potter2@gmail.com |
| 3 | Virat_kohli | Virat | Kohli | 8886878915 | viratkohli18@gmail.com |
| 4 | Anumol_bondu | Bondu | Anumol | 9090900000 | bondanumol4@gmail.com |
| 5 | James_cameroon | James | Cameroon | 6577654567 | cameroon55@gmail.com |
| 6 | Ram_charan | Ram | Charan | 9885278915 | ramcharan@gmail.com |
| 7 | Star_lord | Revanth | Posina | 8128038164 | revanthposina@gmail.com |

## Table : ENROLLS

| USER_ID | COURSE_ID | ENROLL_DATE | ENROLL_STATUS |
|---------|-----------|-------------|---------------|
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| 3 | 102 | 01/09/2024 | In progress |
| 4 | 103 | 02/10/2023 | Yet to start |
| 5 | 104 | 06/05/2023 | Yet to start |
| 6 | 105 | 01/31/2023 | Completed |
| 7 | 105 | 01/30/2023 | In progress |
| 3 | 103 | 02/02/2023 | Yet to start |
| 7 | 100 | 07/17/2023 | Yet to start |

## Table : COURSES

| COURSE_ID | COURSE_NAME | COURSE_STDATE | ENROLLMENT_ENDATE | COURSE_DURATION | COURSE_PRICE | COURSE_RATING |
|-----------|-------------|---------------|-------------------|-----------------|--------------|---------------|
| 100 | Introduction to informatics | 09/17/2023 | 12/16/2023 | 3 months | 280.12 | 2.75 |
| 101 | Data mining | 01/08/2023 | 03/07/2023 | 3 months | 360.89 | 3.2 |
| 102 | Software engineering | 12/12/2023 | 04/11/2024 | 4 months | 440.44 | 2.9 |
| 103 | Deep learning | 05/16/2023 | 10/15/2023 | 5 months | 150.98 | 3.6 |

| 104 | Advance database technologies | 06/06/2023 | 12/05/2023 | 6 months | 270.80 | 3.4 |
| 105 | Database design | 02/27/2023 | 04/26/2023 | 2 months | 360.42 | 3.7 |

## TABLE: UNIVERSITY

| UNIVERSITY_ID | UNIVERSITY_NAME | UNIVERSITY_QSRANKING |
|---|---|---|
| 10001 | Indiana university indianapolis | 500 |
| 10002 | Purdue university | 140 |
| 10003 | University of houston | 600 |
| 10004 | Rice university | 250 |
| 10005 | Indiana university bloomington | 280 |
| 10006 | Arizona state university | 150 |

**ENTITY RELATIONSHIP DIAGRAM**

**PAYMENT_DETAILS**

| PK/FK | USER_ID |
|---|---|
| | USER_CARDNUM |
| | EXP_DATE |
| | USER_CVV |
| | CARD_COUNTRY |

**PAYMENT_HISTORY**

| PK | PAY_ID |
|---|---|
| FK1 | USER_ID |
| | PAY_DESCRI |
| | PAY_TIMESTAMP |
| | PAY_AMOUNT |

**ASSIGNMENTS**

| PK | ASSIGN_ID |
|---|---|
| FK1 | COURSE_ID |
| | ASSIGN_DUEDATE |
| | ASSIGN_MAXG |
| | ASSIGN_DESC |
| | ASSIGN_ATTACH |
| | ASSIGN_FEEDBACK |

**ASSIGNMENT_HISTORY**

| PK,FK1 | USER_ID |
|---|---|
| PK,FK2 | ASSIGN_ID |
| | ASSIGN_MARKS |
| | ASSIGN_SUBMIT_DATE |

**USERS**

| PK | USER_ID |
|---|---|
| | USER_NAME |
| | USER_FNAME |
| | USER_LNAME |
| | EMAIL_ID |
| | PASSWORD |
| | USER_DOB |
| | PHN_NO |
| | USER_LOCATION |
| | USER_CATEGORY |
| | USER_DESCRIPTION |
| | CAREER_GOAL |

**PRIVACY_SETTING**

| PK | SETTINGS_ID |
|---|---|
| FK1 | USER_ID |
| | SEND_EMAILS |
| | SHARE_LOCATION |
| | SHARE_DATA |

**CERTIFICATIONS**

| PK | CERT_ID |
|---|---|
| FK1 | USER_ID |
| FK2 | UNIVERSITY_ID |
| FK3 | COURSE_ID |
| | CERT_NAME |
| | CERT_ISSUE_DATE |
| | CERT_VALID_DATE |
| | CERT_GRADE |

**COURSES**

| PK,FK1 | USER_ID |
|---|---|
| PK | COURSE_ID |
| FK2 | UNIVERSITY_ID |
| | COURSE_STDATE |
| | ENROLLMENT_ENDATE |
| | COURSE_DURATION |
| | COURSE_PRICE |
| | COURSE_DESCRIPTION |
| | COURSE_RATING |
| | COURSE_LEVEL |
| | COURSE_PREREQUISITE |

**ENROLLS**

| PK,FK1 | USER_ID |
|---|---|
| PK,FK2 | COURSE_ID |
| | ENROLL_DATE |
| | ENROLL_STATUS |
| | ENROLL_GRADE |

**NOTIFICATIONS**

| PK | NOTIF_ID |
|---|---|
| FK1 | NOTIF_CONTENT |
| | NOTIF_TIMESTAMP |
| | NOTIF_TIMESTAMP |
| | NOTIF_TYPE |
| | NOTIF_FLAG |

**TARGET_AUDIENCE**

| PK,FK1 | USER_ID |
|---|---|
| PK,FK2 | NOTIF_ID |
| | NOTIF_STATUS |

**UNIVERSITY**

| PK | UNIVERSITY_ID |
|---|---|
| FK1 | UNIVERSITY_NAME |
| | UNIVERSITY_QSRANKING |
| | UNIVERSITY_LOGO |
| | UNIVERSITY_COUNTRY |
| | UNIVERSITY_STATE |
| | UNIVERSITY_CITY |
| | UNIVERSITY_TYPE |

**INSTRUCTOR**

| PK/FK | USER_ID |
|---|---|
| | INST_NAME |
| FK | UNIVERSITY_ID |
| | INST_MAILID |
| | INST_EXP |
| | INST_RT |

**STUDENT**

| PK/FK | USER_ID |
|---|---|
| FK | UNIVERSITY_ID |
| | STUDENT_MAJOR |
| | STUDENT_GRAD_STDATE |
| | STUDENT_GRADEND |
| | STUDENT_GPA |

**EMPLOYEE**

| PK1/FK1 | USER_ID |
|---|---|
| | JOB_TITLE |
| | JOB_INDUSTRY |
| | EMPLOYER |
| | TOTAL_EXP |

Relationships: own, has, make, checks, tracked in, consists of, provide, registers, enrolls into, sets, can be, sent to, issues, offers, teaches, employs, holds, USER_CATEGORY (d)