HW4

Import Required Packages

```r
library(data.table)
library(tidyr)
library(dplyr)
library(ggplot2)
library(anytime) #install.packages("anytime")
library(recommenderlab)#install.packages("recommenderlab")
library(stringr) #install.packages("stringr")
library(readr)
set.seed(800)
```

Q1.

Read data from file after adding new user

```r
#Read the dataset
dataset <- read.csv("cs_books1.csv")
View(dataset)
```

Prepare the data for the recommender system

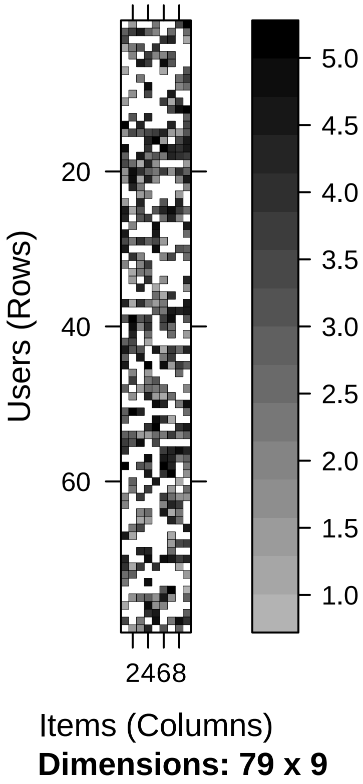
```r
#Prepare the data for the recommender system
ratings_spread <- spread(dataset, key=book, value=rating)
rating_matrix <- as.matrix(ratings_spread[,-1])

dimnames(rating_matrix) <- list(paste("u", unique(dataset$user), sep=""),
                                paste("m", unique(dataset$book), sep=""))
rating_matrix_lab <- as(rating_matrix, "realRatingMatrix")
```

```r
#The created Matrix
getRatingMatrix(rating_matrix_lab)
```

```
## 79 x 9 sparse Matrix of class "dgCMatrix"
##                        mArtificial intelligence mSystems programming
## uMarvin Minsky                             .                    1.46
## uDonald Knuth                              2.95                 3.75
## uEdgar Codd                                3.44                 .
## uMichael Stonebraker                       1.11                 2.41
## uTony Hoare                                .                    2.02
## uJohn Backus                               .                    .
## uJohn McCarthy                             1.26                 .
## uDennis Ritchie                            .                    .
## uAlan Perlis                               .                    .
## uLeslie Lamport                            .                    1.68
## uEdsger Dijkstra                           1.39                 .
## uRobert Floyd                              .                    .
## uNiklaus Wirth                             .                    3.12
## uRobin Milner                              5.00                 .
## uMacauley Mustafa                          1.58                 3.51
## uSultan Armstrong                          .                    .
## uLeandro Warner                            4.92                 .
## uJavier Donovan                            2.90                 .
## uZakariyya Pemberton                       3.54                 2.68
## uFrancesco Hutton                          1.73                 4.91
## uJax Sawyer                                1.85                 4.95
## uLacey-Mai Neal                            .                    4.28
## uBenny Li                                  .                    .
## uIdris William                             1.42                 .
## uThierry Truong                            4.65                 1.09
## uClive Strong                              4.41                 .
## uMohammod Mccabe                           .                    1.99
## uJasleen Flynn                             4.44                 .
## uFarrah Traynor                            3.45                 2.40
## uMilla Callahan                            4.63                 .
## uHester Dunn                               .                    3.93
## uSamad Wilkinson                           1.88                 .
## uNikolas Legge                             .                    1.13
## uHuma Delaney                              .                    1.33
## uUrsula Nichols                            .                    .
## uRoshan Charles                            .                    .
## uSaima Kearns                              4.26                 1.19
## uLyndsey Ahmed                             .                    .
## uFabien Sanchez                            3.03                 5.00
## uSafiyah Humphrey                          .                    4.92
## uWilma Sloan                               .                    4.16
## uLouie Fowler                              2.79                 3.53
## uZackery Woodcock                          4.49                 3.20
## uIga Reyes                                 2.85                 .
## uTyler-James Cleveland                     4.63                 .
## uJoao Hammond                              .                    2.13
## uEmer Irwin                                .                    3.62
## uSalma Ellis                               2.92                 .
## uAntonia Shannon                           .                    1.69
## uJane Bouvet                               .                    .
## uEllice Haas                               2.76                 5.00
## uDrew Peck                                 2.89                 .
## uTymon Sweeney                             .                    .
## uDarrel Thorne                             2.83                 2.88
## uKristy Cantrell                           3.76                 3.19
## uConor Dickson                             3.95                 .
## uIolo Howell                               .                    .
## uLloyd Currie                              5.00                 .
## uShane Mayer                               .                    .
## uDesiree Riley                             .                    2.73
## uEmeli Ponce                               .                    2.20
## uIrfan Heaton                              2.00                 .
## uKai Plummer                               2.03                 .
## uXavier Copeland                           .                    .
## uLeigh Zhang                               .                    .
## uChyna Kemp                                .                    2.30
## uLinzi Mcgill                              4.44                 1.27
## uFenton Higgs                              .                    .
## uTed Weber                                 .                    .
## uTeddy Emery                               4.38                 .
## uAlishba Gaines                            4.02                 1.17
## uAntoinette Dalby                          2.46                 2.80
## uMaysa Whyte                               2.18                 .
## uEshal Philip                              .                    .
## uAngelika Smart                            .                    1.68
## uVerity Miles                              1.23                 .
## uDanyl Connor                              .                    .
## uHakim Cherry                              3.29                 .
## uUser1                                     .                    1.57
##                        mComputation mAlgorithms
## uMarvin Minsky                 .           .
## uDonald Knuth                  4.57        2.83
## uEdgar Codd                    .           .
## uMichael Stonebraker           3.25        .
## uTony Hoare                    .           3.63
## uJohn Backus                   4.70        3.75
## uJohn McCarthy                 .           .
## uDennis Ritchie                2.36        .
## uAlan Perlis                   .           4.73
## uLeslie Lamport                .           3.41
## uEdsger Dijkstra               .           .
## uRobert Floyd                  .           .
## uNiklaus Wirth                 .           4.37
## uRobin Milner                  4.39        .
## uMacauley Mustafa              2.86        3.49
## uSultan Armstrong              .           4.28
## uLeandro Warner                .           3.97
## uJavier Donovan                4.44        2.28
## uZakariyya Pemberton           1.04        4.37
## uFrancesco Hutton              4.06        2.78
## uJax Sawyer                    1.10        4.35
## uLacey-Mai Neal                2.33        .
## uBenny Li                      1.56        2.04
## uIdris William                 4.22        .
## uThierry Truong                3.04        .
## uClive Strong                  3.28        3.75
## uMohammod Mccabe               .           .
## uJasleen Flynn                 .           .
## uFarrah Traynor                4.06        2.78
## uMilla Callahan                .           .
## uHester Dunn                   2.01        .
## uSamad Wilkinson               2.05        3.78
## uNikolas Legge                 2.37        2.21
## uHuma Delaney                  .           4.04
## uUrsula Nichols                4.33        .
## uRoshan Charles                .           .
## uSaima Kearns                  3.87        2.24
## uLyndsey Ahmed                 .           .
## uFabien Sanchez                3.23        3.61
## uSafiyah Humphrey              1.98        4.02
## uWilma Sloan                   .           2.70
## uLouie Fowler                  .           1.09
## uZackery Woodcock              3.14        .
## uIga Reyes                     4.67        .
## uTyler-James Cleveland         .           5.00
## uJoao Hammond                  .           1.48
## uEmer Irwin                    .           2.24
## uSalma Ellis                   1.48        2.50
## uAntonia Shannon               .           4.37
## uJane Bouvet                   .           .
## uEllice Haas                   4.32        .
## uDrew Peck                     .           .
## uTymon Sweeney                 .           4.14
## uDarrel Thorne                 1.30        1.54
## uKristy Cantrell               4.99        .
## uConor Dickson                 .           .
## uIolo Howell                   .           4.77
## uLloyd Currie                  3.18        2.92
## uShane Mayer                   .           4.62
## uDesiree Riley                 .           .
## uEmeli Ponce                   .           3.76
## uIrfan Heaton                  3.62        .
## uKai Plummer                   .           .
## uXavier Copeland               1.86        2.44
## uLeigh Zhang                   1.02        1.48
## uChyna Kemp                    3.46        .
## uLinzi Mcgill                  .           .
## uFenton Higgs                  .           .
## uTed Weber                     4.42        4.31
## uTeddy Emery                   .           4.88
## uAlishba Gaines                3.61        .
## uAntoinette Dalby              .           .
## uMaysa Whyte                   .           4.92
## uEshal Philip                  .           .
## uAngelika Smart                2.53        2.78
## uVerity Miles                  .           4.85
## uDanyl Connor                  .           4.14
## uHakim Cherry                  2.26        .
## uUser1                         1.74        4.25
##                        mProgramming language theory mConcurrency
## uMarvin Minsky                                 2.32         .
## uDonald Knuth                                  1.96         .
## uEdgar Codd                                    .            4.04
## uMichael Stonebraker                           4.03         .
## uTony Hoare                                    1.86         1.95
## uJohn Backus                                   .            4.72
## uJohn McCarthy                                 .            1.12
## uDennis Ritchie                                .            .
## uAlan Perlis                                   .            .
## uLeslie Lamport                                .            .
## uEdsger Dijkstra                               .            3.82
## uRobert Floyd                                  .            .
## uNiklaus Wirth                                 .            .
## uRobin Milner                                  .            .
## uMacauley Mustafa                              3.65         4.40
## uSultan Armstrong                              5.00         1.53
## uLeandro Warner                                .            5.00
## uJavier Donovan                                3.04         2.29
## uZakariyya Pemberton                           1.80         .
## uFrancesco Hutton                              2.31         3.80
## uJax Sawyer                                    1.82         .
## uLacey-Mai Neal                                .            .
## uBenny Li                                      .            .
## uIdris William                                 .            3.28
## uThierry Truong                                3.16         4.41
## uClive Strong                                  .            2.61
## uMohammod Mccabe                               4.77         .
## uJasleen Flynn                                 4.47         .
## uFarrah Traynor                                3.48         1.48
## uMilla Callahan                                4.80         .
## uHester Dunn                                   .            1.93
## uSamad Wilkinson                               .            .
## uNikolas Legge                                 .            .
## uHuma Delaney                                  .            1.79
## uUrsula Nichols                                1.22         .
## uRoshan Charles                                2.48         1.08
## uSaima Kearns                                  1.30         2.22
## uLyndsey Ahmed                                 2.80         2.42
## uFabien Sanchez                                .            3.58
## uSafiyah Humphrey                              .            3.54
## uWilma Sloan                                   .            .
## uLouie Fowler                                  .            .
## uZackery Woodcock                              4.60         1.02
## uIga Reyes                                     .            2.40
## uTyler-James Cleveland                         .            4.93
## uJoao Hammond                                  .            .
## uEmer Irwin                                    3.13         .
## uSalma Ellis                                   2.19         2.64
## uAntonia Shannon                               1.34         1.21
## uJane Bouvet                                   4.85         4.29
## uEllice Haas                                   .            .
## uDrew Peck                                     4.86         3.89
## uTymon Sweeney                                 5.00         .
## uDarrel Thorne                                 2.66         2.16
## uKristy Cantrell                               3.44         .
## uConor Dickson                                 .            3.83
## uIolo Howell                                   .            4.67
## uLloyd Currie                                  .            5.00
## uShane Mayer                                   .            3.94
## uDesiree Riley                                 4.54         .
## uEmeli Ponce                                   .            .
## uIrfan Heaton                                  .            3.59
## uKai Plummer                                   .            1.95
## uXavier Copeland                               .            4.51
## uLeigh Zhang                                   .            .
## uChyna Kemp                                    .            .
## uLinzi Mcgill                                  .            .
## uFenton Higgs                                  .            .
## uTed Weber                                     .            .
## uTeddy Emery                                   .            4.72
## uAlishba Gaines                                3.88         .
## uAntoinette Dalby                              .            .
## uMaysa Whyte                                   .            .
## uEshal Philip                                  .            3.00
## uAngelika Smart                                1.63         4.52
## uVerity Miles                                  1.71         2.10
## uDanyl Connor                                  4.68         .
## uHakim Cherry                                  4.76         .
## uUser1                                         .            3.09
##                        mSoftware engineering mFormal methods mDatabases
## uMarvin Minsky                            .               3.34       5.00
## uDonald Knuth                             2.59            .          2.68
## uEdgar Codd                               4.33            .          1.12
## uMichael Stonebraker                      .               .          .
## uTony Hoare                               3.09            .          .
## uJohn Backus                              3.02            .          .
## uJohn McCarthy                            .               .          3.24
## uDennis Ritchie                           .               2.43       3.68
## uAlan Perlis                              .               2.10       2.47
## uLeslie Lamport                           4.45            .          .
## uEdsger Dijkstra                          1.06            3.70       .
## uRobert Floyd                             3.45            4.83       5.00
## uNiklaus Wirth                            .               .          2.96
## uRobin Milner                             4.33            .          3.57
## uMacauley Mustafa                         1.42            1.45       3.08
## uSultan Armstrong                         .               3.54       4.60
## uLeandro Warner                           4.34            4.04       4.52
## uJavier Donovan                           4.36            3.88       3.77
## uZakariyya Pemberton                      .               .          1.54
## uFrancesco Hutton                         1.59            4.06       2.94
## uJax Sawyer                               .               1.88       4.58
## uLacey-Mai Neal                           .               .          1.93
## uBenny Li                                 .               1.35       .
## uIdris William                            .               4.24       .
## uThierry Truong                           4.98            3.62       2.46
## uClive Strong                             4.16            1.94       .
## uMohammod Mccabe                          .               .          4.51
## uJasleen Flynn                            .               .          2.51
## uFarrah Traynor                           .               .          .
## uMilla Callahan                           .               3.00       2.87
## uHester Dunn                              3.55            .          2.46
## uSamad Wilkinson                          .               .          .
## uNikolas Legge                            .               .          .
## uHuma Delaney                             .               .          4.16
## uUrsula Nichols                           .               .          1.69
## uRoshan Charles                           3.95            .          .
## uSaima Kearns                             .               .          4.53
## uLyndsey Ahmed                            4.58            4.38       4.43
## uFabien Sanchez                           4.72            .          3.25
## uSafiyah Humphrey                         2.71            .          .
## uWilma Sloan                              2.71            .          1.46
## uLouie Fowler                             .               .          .
## uZackery Woodcock                         3.83            2.49       4.29
## uIga Reyes                                3.71            .          .
## uTyler-James Cleveland                    1.50            3.76       2.76
## uJoao Hammond                             .               2.50       .
## uEmer Irwin                               .               .          .
## uSalma Ellis                            .               .          2.02
## uAntonia Shannon                        2.58            .          .
## uJane Bouvet                            .               2.17       4.75
## uEllice Haas                            .               .          2.54
## uDrew Peck                              1.25            .          .
## uTymon Sweeney                          .               3.86       4.67
## uDarrel Thorne                          3.82            2.05       2.77
## uKristy Cantrell                        .               .          .
## uConor Dickson                          4.23            4.74       4.22
## uIolo Howell                            4.34            2.32       2.86
## uLloyd Currie                           4.24            .          2.17
## uShane Mayer                            5.00            .          1.66
## uDesiree Riley                          .               1.21       .
## uEmeli Ponce                            1.52            .          2.59
## uIrfan Heaton                           2.49            1.71       1.70
## uKai Plummer                            4.23            3.72       .
## uXavier Copeland                        1.04            2.39       .
## uLeigh Zhang                            4.25            2.60       .
## uChyna Kemp                             .               .          4.62
## uLinzi Mcgill                           1.12            .          .
## uFenton Higgs                           1.30            3.52       3.64
## uTed Weber                              2.53            .          .
## uTeddy Emery                            4.64            3.62       4.38
## uAlishba Gaines                         .               1.12       .
## uAntoinette Dalby                       .               .          1.46
## uMaysa Whyte                            .               .          .
## uEshal Philip                           5.00            .          1.00
## uAngelika Smart                         1.64            .          2.88
## uVerity Miles                           .               .          .
## uDanyl Connor                           .               .          2.99
## uHakim Cherry                           2.20            4.78       3.86
## uUser1                                  .               2.91       .
```

```
image(rating_matrix_lab)
```



```
#Print all types of recommenders systems
recommenderRegistry$get_entry_names()
```

```
##  [1] "ALS_realRatingMatrix"             "ALS_implicit_realRatingMatrix"
##  [3] "ALS_implicit_binaryRatingMatrix" "AR_binaryRatingMatrix"
##  [5] "IBCF_binaryRatingMatrix"          "IBCF_realRatingMatrix"
##  [7] "POPULAR_binaryRatingMatrix"       "POPULAR_realRatingMatrix"
##  [9] "RANDOM_realRatingMatrix"          "RANDOM_binaryRatingMatrix"
## [11] "RERECOMMEND_realRatingMatrix"     "SVD_realRatingMatrix"
## [13] "SVDF_realRatingMatrix"            "UBCF_binaryRatingMatrix"
## [15] "UBCF_realRatingMatrix"
```

```
#get the matrix of the new user
new_user <- rating_matrix_lab[79]
#Select all users except the new user
rating_matrix_lab = rating_matrix_lab[1:78]

rating_matrix_lab
```

```
## 78 x 9 rating matrix of class 'realRatingMatrix' with 357 ratings.
```

```
#Split the dataset into 20% of test data and 80% of train
train_idx <- sample(nrow(rating_matrix_lab), round(nrow(rating_matrix_lab)/100*80,0), replace = F)

train <- rating_matrix_lab[train_idx,]
test <- rating_matrix_lab[-train_idx,]
```

Q2. Predict rating for the first 10 users for each of the 3 recommender systems you have selected in the previous task.

```r
#First recommender system
model_popular <- Recommender(train, "POPULAR")
#Predict recommendation for 10 users
prediction_popular <- predict(model_popular,test[1:10],n=10, type="ratings")
as(prediction_popular, "list")
```

```
## $`uTony Hoare`
## mArtificial intelligence             mComputation          mFormal methods
##                 2.471337                 2.620745                 2.254502
##               mDatabases
##                 2.374586
##
## $`uDennis Ritchie`
##     mArtificial intelligence         mSystems programming
##                     2.784671                     2.670251
##                  mAlgorithms mProgramming language theory
##                     3.197917                     2.991054
##                 mConcurrency        mSoftware engineering
##                     2.757587                     2.781765
##
## $`uMacauley Mustafa`
## named numeric(0)
##
## $`uLeandro Warner`
##         mSystems programming                 mComputation
##                     4.311917                     4.575745
## mProgramming language theory
##                     4.632720
##
## $`uMilla Callahan`
##  mSystems programming          mComputation           mAlgorithms
##              3.671917              3.935745              4.199584
##          mConcurrency mSoftware engineering
##              3.759254              3.783432
##
## $`uSaima Kearns`
## mSoftware engineering       mFormal methods
##              2.759861              2.545931
##
## $`uSafiyah Humphrey`
##     mArtificial intelligence mProgramming language theory
##                     3.395337                     3.601720
##               mFormal methods                   mDatabases
##                     3.178502                     3.298586
##
## $`uWilma Sloan`
##     mArtificial intelligence                 mComputation
##                     2.718837                     2.868245
## mProgramming language theory                 mConcurrency
##                     2.925220                     2.691754
##              mFormal methods
##                     2.502002
##
## $`uIga Reyes`
##         mSystems programming                   mAlgorithms
##                     3.254417                      3.782084
## mProgramming language theory               mFormal methods
##                     3.575220                      3.152002
##                   mDatabases
##                     3.272086
##
## $`uAntonia Shannon`
## mArtificial intelligence             mComputation          mFormal methods
##                 2.199337                 2.348745                 1.982502
##               mDatabases
##                 2.102586
```

```r
#second recommender system
model_Random <- Recommender(train, "RANDOM")
prediction_Random <- predict(model_Random, test[1:10],n=10, type="ratings")
as(prediction_Random, "list")
```

```
## [[1]]
## mArtificial intelligence             mComputation          mFormal methods
##                 1.460000                 3.786047                 2.506221
##               mDatabases
##                 2.718447
##
## [[2]]
##     mArtificial intelligence         mSystems programming
##                     4.166053                      3.055480
##                  mAlgorithms mProgramming language theory
##                     2.559004                      3.513726
##                 mConcurrency        mSoftware engineering
##                     3.177326                      3.363046
##
## [[3]]
## named numeric(0)
##
## [[4]]
##         mSystems programming                  mComputation
##                     3.580131                      4.717481
## mProgramming language theory
##                     4.423268
##
## [[5]]
##  mSystems programming          mComputation           mAlgorithms
##              3.760331              3.659947              3.913443
##          mConcurrency mSoftware engineering
##              3.665986              3.652569
##
## [[6]]
## mSoftware engineering       mFormal methods
##              4.550709              4.522199
##
```

```
## [[7]]
##     mArtificial intelligence mProgramming language theory 
##                     2.438069                     1.040569 
##              mFormal methods                   mDatabases 
##                     3.470430                     3.382784 
## 
## [[8]]
##     mArtificial intelligence                 mComputation 
##                     1.092157                     3.586266 
## mProgramming language theory                 mConcurrency 
##                     1.940291                     2.124737 
##              mFormal methods 
##                     3.426962 
## 
## [[9]]
##         mSystems programming                  mAlgorithms 
##                     3.273710                     3.644188 
## mProgramming language theory              mFormal methods 
##                     2.486374                     2.694993 
##                   mDatabases 
##                     4.035116 
## 
## [[10]]
## mArtificial intelligence             mComputation          mFormal methods 
##                 1.600178                 2.196812                 3.228939 
##               mDatabases 
##                 1.413846
```

```
#third recommender system
model_UBCF <- Recommender(train, "UBCF")
prediction_UBCF <- predict(model_UBCF, test[1:10],n=10, type="ratings")
as(prediction_UBCF, "list")
```

```
## $`uTony Hoare`
## mArtificial intelligence             mComputation          mFormal methods 
##                 2.235313                 2.602377                 2.587492 
##               mDatabases 
##                 2.512104 
## 
## $`uDennis Ritchie`
##     mArtificial intelligence         mSystems programming 
##                     2.626102                     2.697487 
##                  mAlgorithms mProgramming language theory 
##                     3.115956                     3.099870 
##                 mConcurrency        mSoftware engineering 
##                     2.632876                     2.743652 
## 
## $`uMacauley Mustafa`
## named numeric(0)
## 
## $`uLeandro Warner`
##         mSystems programming                 mComputation 
##                     4.299920                     4.657870 
## mProgramming language theory 
##                     4.614063
```

```
##
## $`uMilla Callahan`
##  mSystems programming          mComputation           mAlgorithms
##              3.738012              3.803740              3.986503
##          mConcurrency mSoftware engineering
##              3.660839              3.865132
##
## $`uSaima Kearns`
## mSoftware engineering       mFormal methods
##              2.852966              2.717202
##
## $`uSafiyah Humphrey`
##     mArtificial intelligence mProgramming language theory
##                     3.211670                     3.663128
##              mFormal methods                   mDatabases
##                     3.253227                     3.552997
##
## $`uWilma Sloan`
##     mArtificial intelligence                 mComputation
##                     2.540003                     3.026972
## mProgramming language theory                 mConcurrency
##                     3.015715                     2.733687
##              mFormal methods
##                     2.567900
##
## $`uIga Reyes`
##         mSystems programming                  mAlgorithms
##                     3.306265                     3.601434
## mProgramming language theory              mFormal methods
##                     3.335878                     3.392867
##                   mDatabases
##                     3.477755
##
## $`uAntonia Shannon`
## mArtificial intelligence             mComputation          mFormal methods
##                 1.989681                 2.321064                 2.365532
##               mDatabases
##                 2.092464
```

Q3. Use measures (RMSE, MAE) to evaluate the performance of the models. Which model performs better than others and why?

```
eval_scheme <- evaluationScheme(rating_matrix_lab, method="split", train=0.8, given=-1)
#2 ratings of 20% of users (per user) are excluded for testing

model_popular <- Recommender(getData(eval_scheme, "train"), "POPULAR")

prediction_popular <- predict(model_popular, getData(eval_scheme, "known"), type="ratings")


rmse_popular <- calcPredictionAccuracy(prediction_popular,
                                       getData(eval_scheme, "unknown"))[1]
```

```
rmse_popular
```

```
##     RMSE
## 1.573969
```

```
model_ubcf <- Recommender(getData(eval_scheme, "train"),
                          "UBCF")

prediction_ubcf <- predict(model_ubcf, getData(eval_scheme, "known"), type="ratings")

rmse_ubcf <- calcPredictionAccuracy(prediction_ubcf, getData(eval_scheme, "unknown"))[1]
rmse_ubcf
```

```
##     RMSE
## 1.604937
```

```
model_random <- Recommender(getData(eval_scheme, "train"), "RANDOM")

prediction_Random <- predict(model_random, getData(eval_scheme, "known"), type="ratings")


rmse_random <- calcPredictionAccuracy(prediction_Random,
                                       getData(eval_scheme, "unknown"))[1]
rmse_random
```

```
##     RMSE
## 1.818836
```

Using the following table, we can compare between the different models. We can see that model popular is the best in performance because is has the lowest MSE, RMSE, and MAE. Lowest MSE means that the difference between the original and the predicted one is very low, which means it's a better model.

```
#Compare models

rbind(calcPredictionAccuracy(prediction_popular, getData(eval_scheme, "unknown")),
      calcPredictionAccuracy(prediction_ubcf, getData(eval_scheme, "unknown")),
      calcPredictionAccuracy(prediction_Random, getData(eval_scheme, "unknown")))
```

```
##          RMSE      MSE      MAE
## [1,] 1.573969 2.477378 1.336411
## [2,] 1.604937 2.575822 1.363182
## [3,] 1.818836 3.308166 1.600704
```

Q4 Add a new user (with username "User1") in your data. Suggest what books should User1 read?

We added User1 from the beginning, the we sugest to user1 what he should read.

```
model_popular <- Recommender(getData(eval_scheme, "train"), "POPULAR")
new_userPrediction <- predict(model_popular,new_user,n=10, type="ratings")
as(new_userPrediction, "list")
```

```
## $uUser1
##     mArtificial intelligence mProgramming language theory
##                     2.726171                     2.818484
##        mSoftware engineering                   mDatabases
##                     2.692743                     2.425372
```