Um prófið / About the exam

Þetta próf samanstendur af þremur forritunarverkefnum sem samtals gefa 60 stig. Lesið leiðbeiningar með sérhverju verkefni gaumgæfilega. Þið eigið að þróa og prófa lausnirnar ykkar í VS Code og síðan að senda þær inn í Coding Rooms.

InfoWarningTip

Það er mikilvægt að sérhver útfærsla á verkefni keyri, þ.e. hafi ekki í för með sér villu á keyrslutíma. Þetta þýðir að betra er að skila verkefni sem útfærir ekki alla virkni en keyrir án villna heldur en verkefni sem útfærir meira en veldur villum á keyrslutíma.

Hafið þessar reglur sérstaklega í huga:

- **Rule 1:** Think before you program.
- **Rule 2**: A program is a human readable essay on problem solving that also happens to execute on a computer.
- **Rule 5**: Test your code, often and thoroughly!
- **Rule 6**: If it was hard to write, it is probably hard to read. Add a comment.
- **Rule 8**: A function should do one thing.

InfoWarningTip

Það má ekki nota annað import í þessu prófi en það sem gefið er upp í starter code en þeir sem vilja nota tagskilgreiningar mega þó nota "import typing".

#English

This exam consists of three programming projects, totalling 60 points. Make sure that you read the instructions for each assignment thoroughly. You should implement and test your solutions in VS Code and then submit them in Coding Rooms.

InfoWarningTip

It is important that your implementations run, i.e. that run-time errors do not occur. This means that it is better to return a solution that does not implement all functionality, but runs without errors, as opposed to a solution that implements more functionality but results in run-time errors.

Keep the following rules in mind:

- **Rule 1:** Think before you program.
- **Rule 2**: A program is a human readable essay on problem solving that also happens to execute on a computer.
- **Rule 5**: Test your code, often and thoroughly!
- **Rule 6**: If it was hard to write, it is probably hard to read. Add a comment.
- **Rule 8**: A function should do one thing.

InfoWarningTip

You are not allowed to use other import in this exam than what appears in starter code, but those who want to use type definitions can use "import typing".

Reglur og yfirlýsing / Rules and statement

Eftirfarandi reglur gilda um þetta próf:

- Prófið er "open book" í þeim skilningi að leyfileg hjálpargögn eru:
  - Kennslubókin
  - Glærur
  - Glósur
  - Forritskóði á eigin tölvu

- Það er leyfilegt að fara inn á eftirtaldar vefsíður:
  - Canvas
  - Coding Rooms
  - Piazza
  - Rafræna útgáfu af kennslubók

  en **bannað** að fara inn á aðrar vefsíður.

Athugið jafnframt að:

- EKKI er heimilt að hafa samskiptatól eða samfélagstól opið, eins og tölvupóst, Facebook, Messenger, Discord, o.s.frv. Samskipti við utanaðkomandi aðila eru algerlega bönnuð.
- Nemanda er EKKI heimilt að veita öðrum nemendum aðgang að prófverkefnum eða lausnum fyrr en eftir kl. 19:00.
- Nemanda er EKKI heimilt að opna prófið á ný eftir að hann hefur yfirgefið salinn/herbergið.

InfoWarningTip

Brot á þessum reglum þýðir að viðkomandi fær 0 í prófinu og brotin eru jafnframt meðhöndluð skv. almennum reglum um nám og námsmat í HR.

#English

The following rules apply in this exam:

- The exam is open book, meaning that the allowable helping material is:

    - The textbook
    - Slides
    - Notes
    - Program code on own computer

- It is allowed to visit the following webpages:
    - Canvas
    - Coding Rooms
    - Piazza
    - Electronic version of the textbook

  other webpages are disallowed.

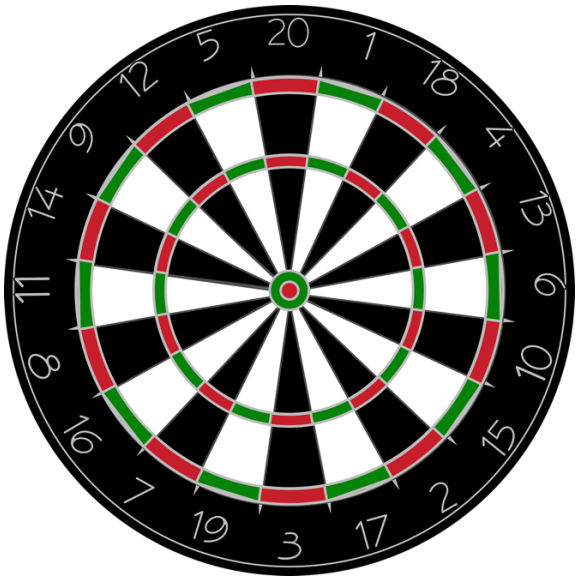
Note also that:

- It is NOT allowed to open a communication or social media tool, like email, Facebook, Messenger, Discord, etc. Communicating with an outside person is strictly forbidden.
- The student is NOT allowed to give other students access to the exam projects or solutions until after 19:00.
- The student is NOT allowed to open the exam again after the student has left the exam room.

InfoWarningTip

Breaking these rules means that the student gets the grade 0 in the exam. Violations of these rules are also dealt with according to general rules for study and assessment at RU.

1. Darts (18 stig; 30%)



Skrifið forrit, *darts.py*, sem leyfir notanda að skrá skor tveggja keppenda í pílu endurtekið þangað til annar keppendanna hefur unnið leikinn.

- Um er að ræða svokallað "301 darts" sem þýðir að báðir keppendur byrja með 301 stig.
- Keppendur skiptast síðan á að kasta pílunum á píluspjaldið og í hverri umferð er fjöldi stiga sem pílurnar gefa dreginn frá heildarfjöldanum.
- Sá vinnur sem fyrr kemst niður í 0 stig.
- Ef keppandi skorar fleiri stig í tiltekinni umferð en sem nemur heildarfjölda stiga sem hann á eftir þá er viðkomandi kast ógilt og heildarfjöldi stiga sem eftir eru breytist þá ekki.
- Skorin sem slegin eru inn þarf að villutékka, þ.e. að tryggja að þau séu heiltölur.
- Fastar eru gefnir sem þið EIGIÐ að nota.

Write a program, darts.py, which allows the user to repeatedly input the scores of two players in darts until one of them wins.

- The game is the so-called "301 darts", which means that both players start with a score of 301 points.
- Each player then takes alternating turns at throwing their darts at the dartboard and the points scored are subtracted from the total.
- The first player to reach zero points wins the game.
- If a player scores more points in a given round than the total points remaining, then the throw is invalid and the remaining total points are not changed.
- The entered scores need to be error checked, i.e. ensuring that they are integers.
- Constants are given which you MUST use.

Dæmi um inntak/úttak - Example input/output:

```
Input points for Player 1: 180
Player 1 remaining points: 121
Input points for Player 2: 60
Player 2 remaining points: 241
Input points for Player 1: 40
Player 1 remaining points: 81
Input points for Player 2: x
Invalid input!
Input points for Player 2: y
Invalid input!
Input points for Player 2: 100
Player 2 remaining points: 141
Input points for Player 1: 21
Player 1 remaining points: 60
Input points for Player 2: 40
Player 2 remaining points: 101
Input points for Player 1: 120
Player 1 remaining points: 60
Input points for Player 2: 40
Player 2 remaining points: 61
Input points for Player 1:
Invalid input!
Input points for Player 1: 60
Player 1 remaining points: 0
Player 1 won!
```

Línur sem byrja á "Input" eru inntak en allar aðrar línur eru úttak. Hér sést að heildarfjöldi stiga sem leikmaður á eftir eru skrifuð út í hverri umferð. Jafnframt eru skilaboð skrifuð út ef inntak er ógilt. Að lokum eru upplýsingar um sigurvegarann skrifaðar út.

Lines starting with "Input" are inputs, while all other lines are outputs. Here it can be seen that the total remaining points for a player are printed out in each round. Moreover, an error message is printed when the input is invalid. Finally, information about the winner is printed.

2. Movies (27 stig; 45%)

Skrifið forrit, *movies.py*, sem les gögn úr skrá sem geymir upplýsingar um X-bestu kvikmyndir miðað við einkunnir sem gefnar hafa verið af áhorfendum og býður notanda upp á að framkvæma ákveðnar aðgerðir sem tengjast gögnunum. Inntaksskrá, fyrir 20-bestu kvikmyndir (movies-top-20.csv), lítur svona út:

Write a program, *movies.py*, that extracts data from a file that contains information about X-best movies according to ratings given by the viewers, and allows the user to perform certain operations related to the data. An input file, for the 20-best movies (movies-top-20.csv), looks like this:

```
The Shawshank Redemption;9.2;1994
The Godfather;9.1;1972
The Godfather: Part II;9.0;1974
Il buono, il brutto, il cattivo;8.9;1966
Pulp Fiction;8.9;1994
Inception;8.9;2010
Schindler's List;8.9;1993
12 Angry Men;8.9;1957
One Flew Over the Cuckoo's Nest;8.8;1975
The Dark Knight;8.8;2008
Star Wars: Episode V - The Empire Strikes Back;8.8;1980
The Lord of the Rings: The Return of the King;8.8;2003
Shichinin no samurai;8.8;1954
Star Wars;8.7;1977
Goodfellas;8.7;1990
Casablanca;8.7;1942
Fight Club;8.7;1999
Cidade de Deus;8.7;2002
The Lord of the Rings: The Fellowship of the Ring;8.7;2001
Rear Window;8.7;1954
```

Semíkomma er notuð á milli dálka í skránni. Fyrsti dálkurinn geymir titil myndar, annar dálkurinn einkunn og þriðji dálkurinn útgáfuárið.

A semi-colon is used as as separator between the columns in the file. The first column contains the movie title, the second column the rating, and the third column the year of the release.

Forritið sýnir valmynd sem býður notanda upp á að framkvæma eftirtaldar aðgerðir / The program displays a menu, allowing the user to perform the following operations:

- Sýna upplýsingar um kvikmyndirnar, í stafrófsröð eftir titli myndar / Display information about the movies, alphabetically ordered by title.
- Sýna alla titla kvikmynda sem gefnar voru út á tilteknu ári / Display all movie titles released in a given year.
- Breyta einkunn allra kvikmynda um tiltekna tölu (athugið að inntaksskránni er þó ekki breytt) / Change the rating of all the movies by a certain number (note, however, that the input file is not changed).

Valmyndin lítur svona út / The menu looks like this:

```
******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************
```

Fjöldinn af '*' sem skrifaður er út er 31. Ef einhver annar valmöguleiki en '1', '2', eða '3' er sleginn inn þá hættir forritið keyrslu.

The number of '*' written out is 31. If any other menu option than '1', '2', or '3' is entered, the program quits running.

InfoWarningTip

Athugið að það á að vera auðvelt að skipta um stafi sem standa fyrir valmöguleikan, t.d. að nota 'a', 'b' og 'c' í stað '1', '2' og 3'.
Note that it should be easy to change the letters that stand for the menu options, e.g. using 'a', 'b', and 'c' instead of '1', '2', and '3'.

Hér fyrir neðan eru dæmi um inntak/úttak sem eiga að gefa ykkur nægar upplýsingar um virkni og úttak forritsins / Here below are input/output examples which should give you enough information about the functionality and the output of the program:

```
#File not found
Enter filename: bla.txt
File bla.txt not found!
```

```
#Movies in alphabetical order
Enter filename: movies-top-20.csv

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: 1
12 Angry Men                                        8.90  1957
Casablanca                                          8.70  1942
Cidade de Deus                                      8.70  2002
Fight Club                                          8.70  1999
Goodfellas                                          8.70  1990
Il buono, il brutto, il cattivo                     8.90  1966
Inception                                           8.90  2010
One Flew Over the Cuckoo's Nest                     8.80  1975
Pulp Fiction                                        8.90  1994
Rear Window                                         8.70  1954
Schindler's List                                    8.90  1993
Shichinin no samurai                                8.80  1954
Star Wars                                           8.70  1977
Star Wars: Episode V - The Empire Strikes Back      8.80  1980
The Dark Knight                                     8.80  2008
The Godfather                                       9.10  1972
The Godfather: Part II                              9.00  1974
The Lord of the Rings: The Fellowship of the Ring   8.70  2001
The Lord of the Rings: The Return of the King       8.80  2003
The Shawshank Redemption                            9.20  1994

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: 0
```

Svæðið fyrir titil kvikmyndar er vinstri jafnað með breiddina 50, svæðið fyrir einkunn kvikmyndar er hægri jafnað með breiddina 6 og með 2 aukastafi og svæðið fyrir ártal er hægri jafnað með breiddina 6.

The field for the movie title is left justified with width 50, the field for the movie rating is right justified with width 6 and 2 digits after the decimal point, and the field for the year is right justified with width 6.

#Titles in given year

```
Enter filename: movies-top-20.csv

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: 2
Enter year: 1994
The Shawshank Redemption
Pulp Fiction

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: q
```

#Modify all ratings

```
Enter filename: movies-top-20.csv

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: 1
12 Angry Men                                          8.90  1957
Casablanca                                            8.70  1942
Cidade de Deus                                        8.70  2002
Fight Club                                            8.70  1999
Goodfellas                                            8.70  1990
Il buono, il brutto, il cattivo                       8.90  1966
Inception                                             8.90  2010
One Flew Over the Cuckoo's Nest                       8.80  1975
Pulp Fiction                                          8.90  1994
Rear Window                                           8.70  1954
Schindler's List                                      8.90  1993
Shichinin no samurai                                  8.80  1954
Star Wars                                             8.70  1977
Star Wars: Episode V - The Empire Strikes Back        8.80  1980
The Dark Knight                                       8.80  2008
The Godfather                                         9.10  1972
The Godfather: Part II                                9.00  1974
The Lord of the Rings: The Fellowship of the Ring     8.70  2001
```

```
The Lord of the Rings: The Return of the King       8.80  2003
The Shawshank Redemption                            9.20  1994

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: 3
Enter modifier for ratings: 0.25

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: 1
12 Angry Men                                        9.15  1957
Casablanca                                          8.95  1942
Cidade de Deus                                      8.95  2002
Fight Club                                          8.95  1999
Goodfellas                                          8.95  1990
Il buono, il brutto, il cattivo                     9.15  1966
Inception                                           9.15  2010
One Flew Over the Cuckoo's Nest                     9.05  1975
Pulp Fiction                                        9.15  1994
Rear Window                                         8.95  1954
Schindler's List                                    9.15  1993
Shichinin no samurai                                9.05  1954
Star Wars                                           8.95  1977
Star Wars: Episode V - The Empire Strikes Back      9.05  1980
The Dark Knight                                     9.05  2008
The Godfather                                       9.35  1972
The Godfather: Part II                              9.25  1974
The Lord of the Rings: The Fellowship of the Ring   8.95  2001
The Lord of the Rings: The Return of the King       9.05  2003
The Shawshank Redemption                            9.45  1994

******************************
1. Movies in alphabetical order
2. Titles in given year
3. Modify all ratings
******************************

Enter your selection: q
```

InfoWarningTip

Eitt fall, open_file() er gefið sem þið VERÐIÐ að nota og megið EKKI breyta.

One function, open_file() is given which you MUST use, and CANNOT change.

3. Team (15 stig; 25%)

Í þessu verkefni eigið þið að útfæra tvo klasa:

- *Player*, í skránni *player.py*, sem hjúpar (fótbolta)leikmann. Ein af public tilvikabreytum í Player er *goals* sem geymir fjölda marka sem viðkomandi leikmaður hefur skorað.
- *Team*, í skránni *team.py*, sem hjúpar (fótbolta)lið.

Með því að skoða aðalforritið hér fyrir neðan ásamt úttaki þess eigið þið að geta áttað ykkur á því hvaða breytur og aðgerðir klasarnir tveir þurfa að hafa.

In this project, you need to implement two classes:

- *Player*, in the file *player.py*, which encapsulates a (soccer) player. One of the public instance variables in Player is *goals* which stores the number of goals that the player has scored.
- *Team*, in the file *team.py*, which encapsulates a soccer (team).

By inspecting the main program below and the corresponding output, you should be able to figure out which variables and methods the two classes need.

Aðalforrit / Main program:

```
import random
from player import Player
from team import Team

def main():
    random.seed(10)

    player1 = Player("Mohamed", "Salah")
    player2 = Player("Roberto", "Firmino")
    player3 = Player("Luis", "Díaz")
    player4 = Player("Marcus", "Rashford")
    player5 = Player("Harry", "Maguire")
    player6 = Player("Christiano", "Ronaldo")
```

```
    players = [player1, player2, player3, player4, player5, player6]
    for player in players:
        goals = random.randint(1,5)
        player.add_goals(goals)
        print(player)

    team1 = Team("Liverpool")
    team1.add_player(player1)
    team1.add_player(player2)
    team1.add_player(player3)
    print(team1)

    team2 = Team("Manchester United")
    team2.add_player(player4)
    team2.add_player(player5)
    team2.add_player(player6)
    print(team2)

    most_goals_player = team1.most_goals_player()
    print(most_goals_player)
    most_goals_player = team2.most_goals_player()
    print(most_goals_player)

    team3 = team1 + team2
    print(team3)
    most_goals_player = team3.most_goals_player()
    print(most_goals_player)


if __name__ == "__main__":
    main()
```

Útttak aðalforrits / The output from the main program:

```
Mohamed Salah, Goals: 5
Roberto Firmino, Goals: 1
Luis Díaz, Goals: 4
Marcus Rashford, Goals: 4
Harry Maguire, Goals: 5
Christiano Ronaldo, Goals: 1
Liverpool:
        Mohamed Salah, Goals: 5
        Luis Díaz, Goals: 4
        Roberto Firmino, Goals: 1
Manchester United:
        Harry Maguire, Goals: 5
        Marcus Rashford, Goals: 4
        Christiano Ronaldo, Goals: 1
Mohamed Salah, Goals: 5
Harry Maguire, Goals: 5
Liverpool+Manchester United:
```

```
        Mohamed Salah, Goals: 5
        Harry Maguire, Goals: 5
        Luis Díaz, Goals: 4
        Marcus Rashford, Goals: 4
        Roberto Firmino, Goals: 1
        Christiano Ronaldo, Goals: 1
Mohamed Salah, Goals: 5
```

InfoWarningTip

Athugið að þegar lið er prentað út þá birtast leikmenn þess í lækkandi röð miðað við fjölda marka sem þeir hafa skorað. Ef tveir eða fleiri leikmenn hafa skorað jafnmörg mörk þá birtist sá fyrstur sem fyrst var bætt við liðið. Einn tab-character kemur í hverri línu á undan upplýsingum um sérhvern leikmann liðsins

Note that when a team is printed out its players are shown in descending order on the number of goals they have scored. If two or more players have scored equal number of goals, the one that was added first to the team is shown first. One tab-character is printed in each line before the information for each player is shown.

InfoWarningTip

Gefum okkur að players sé einhvers konar safn af tilvikum af Player klasanum . Til að raða players í lækkandi röð á skoruð mörk, þá getið þið notað:

sorted(players, key=lambda p: p.goals, reverse=True)

Hér er "lambda p: p.goals" nafnlaust fall sem skilar gildinu á *goals* breytunni í tilvikinu p.

Let us assume that players is some kind of a collection of instances of the Player class. In order to sort players in descending order on goals scored, you can use:

sorted(players, key=lambda p: p.goals, reverse=True)

Here, "lambda p: p.goals" is an anonymous function which returns the value of the *goals* variable in the instance p.