



UNIVERSITY OF ZAGREB



Faculty of Electrical
Engineering and
Computing

Master Programme

Heuristic Optimization Methods

Second homework assignment

Fantasy football draft problem

Ac. year 2021/2022

1 Problem description

Fantasy football is a game where participants serve as managers of virtual football teams. In the Fantasy Premier League (FPL), you are given a task to pick a squad of real-life football players playing in the English Premier League, who score points for your team based on their performances in their own real matches. As a manager, you are given a budget of 100 million virtual currency which can be spent on selecting a squad.

A squad has to have 15 players across four different positions: **goalkeepers**, **defenders**, **midfielders**, and **forwards**. However, only 11 players will make it to the first team lineup, and 4 players have to serve as substitutes.

Points can only be scored by players selected in the first team lineup. Given the list of players with their respective value (price), club, and points scored, your task is to draft a squad of 15 players, and pick the first team lineup, so as to maximize the number of points scored by the selected eleven players on the pitch.

Further details are given in the first homework assignment.

2 Tasks

1. Design and implement a Tabu Search (TS) algorithm to find a solution to the given problem.

- a) As an initial solution, use a solution obtained by the greedy algorithm that you implemented in the first homework assignment. Execute your TS algorithm for the given instances of the problem. For each instance, save the best acquired solution as the value of the objective function (overall score for the "best eleven"), and the list of drafted players, as well as the list of players in the first team lineup.

Now once again use the same initial (greedy) solution and run your Local Search (LS) algorithm implemented in the first homework assignment to obtain solutions to the given instances. Provide a brief discussion comparing solutions obtained using LS and TS.

- b) As an initial solution use a randomly found solution. Execute your TS algorithm for the given instances of the problem. For each instance, save the best acquired solution as the value of objective function (overall score for the "best eleven"), and the list of drafted players, as well as the list of players in the first team lineup.

NOTE: For both tasks given in a) and b): analyze and plot (using a graph) the impact of different tabu tenure sizes on obtained solutions. Compare and comment on their impact on the solution quality. Make sure to clearly specify the structure of your tabu list. Furthermore, try including the aspiration criterion and comment on obtained results. Optional: you may try diversifying your search by including a long-term memory structure.

2. Design and implement a Simulated Annealing (SA) algorithm to find a solution to the given problem.

- a) As an initial solution, use a solution obtained by the greedy algorithm implemented in the first homework assignment. Execute your SA algorithm for the given instances of the problem. For each instance, save the best acquired solution as the value of objective function (overall score for the "best eleven"), and the list of drafted players, as well as

the list of players in the first team lineup.

Now once again use the same initial (greedy) solution and run your Local Search (LS) algorithm implemented in the first homework assignment to obtain solutions to the given instances. Provide a brief discussion comparing solutions obtained using LS and SA.

- b) As an initial solution use a randomly found solution. Execute your SA algorithm for the given instances of the problem. For each instance, save the best acquired solution as the value of objective function (overall score for the "best eleven"), and the list of drafted players, as well as the list of players in the first team lineup.

NOTE: For both tasks given in a) and b): analyze and plot (using a graph) the impact of different initial temperatures on obtained solutions. Compare and comment on their impact on the solution quality. Furthermore, analyze the impact of different temperature decrement functions on obtained solutions.

3. Write a report that describes your implemented algorithms. The report should include the following:
 - a) Programming language used for the algorithm implementation.
 - b) A description of the implemented tabu search and simulated annealing algorithms.
 - c) The pseudocode of the implemented algorithms.
 - d) Results: the value of the objective function, the list of drafted players, as well as the list of players in the first team lineup for the best solutions for each algorithm.
 - e) Analysis (**both** textual and graphical) of the impact of different algorithm techniques (tabu tenure for tabu search, and initial temperature and temperature decrement functions for simulated annealing) on the solution quality.
4. The project is due on **December 20, 2021 at 12 p.m.** Additional information regarding the report and code submission will be provided on the course website.