Code / Project : CME1102 / 1
Year / Semester : 2016-2017 Spring Semester
Duration : 4 weeks

Project: Robot Games

The subject of the project is to develop a game software of some robot games.

General Information

In the robot games, there are several game types. The aim of players is to build a robot team, maintenance it, and win the robot games.

Teams

There are 6 teams in the organization. The first team is controlled by the human player, others are controlled by the computer. Each team has 1500 credits at the beginning of the game.

Teams buy robot modules and build their robots. Then they register robots to the games to win. A team can have max. 9 robots and 20 modules.

Teams are evaluated at the end of every three weeks. If a team participates in min. 2 different game types in a 3week period, it gets additional 150 credits.

Objective of the game is to reach 10000 credits and 6 robots before other teams do.

Robots / Robot Modules

Each robot has exactly 4 modules, and every module has 6 qualities:

- Torso (related to force) : tr1, tr2, tr3, tr4, tr5, tr6
- Head (related to intelligence) : hd1, hd2, hd3, hd4, hd5, hd6
- Legs (mostly related to speed) : lg1, lg2, lg3, lg4, lg5, lg6
- Arms (mostly related to skill) : ar1, ar2, ar3, ar4, ar5, ar6

Robot parts are modular, but each type can be replaced by the same type of module. In other words a torso module can be replaced by a torso module only.
Leg modules contain 2 legs. Arm modules contain 2 arms. These modules cannot be separated.

Prices of Robot Modules

Module	1	2	3	4	5	6
Torso: tr1-tr6	150	300	450	600	750	900
Head: hd1-hd6	100	200	300	400	500	600
Legs: lg1-lg6	50	100	150	200	250	300
Arms: ar1-ar6	40	80	120	160	200	240

Characteristics of Robot Modules

Module	Weight	Force	Intelligence	Skill
Torso: tr1-tr6	100 + TR * 10	100 + TR * 80	-	-
Head: hd1-hd6	20 + HD * 1	-	100 + HD * 160	-
Legs: lg1-lg6	80 + LG * 4	100 + LG * 80	-	-
Arms: ar1-ar6	40 + AR * 2	-	-	100 + AR * 200

```
Speed = (250 * LegForce) / TotalWeigth
```

The "Durability" of each type new module is 100 units. Due to wearing out, durability of modules decreases by 2 units each week and extra 2 units for every game participated. If the durability of a module drops below 60 units, the module cannot be used anymore, but can be sold.

Buy/sell operations are not between teams, but with a General Trade Center. Teams can sell their used modules at any time, but cannot buy used modules. Only new modules can be bought from the General Trade Center. New modulea are always available, at any time.

PriceOfUsedModule = 0.5 * PriceOfNewModule * Durability/100

Games

There are 4 games in every week:

- RoboChess (related to intelligence)
- RoboRun (related to speed)
- RoboSumo (related to force)
- RoboPingPong (mostly related to skill)

There must be min. 1 registered team to play a game. Otherwise, the prize of the game is transferred to the next week.

A robot can participate in only one game in a week. Team's registered robots are kept secret until the game starts. Before the games start, each team can see the other teams' robots.

A team can register more than one robot to a game. Team score is calculated as follows:

TeamScore = (Robot1Score + Robot2Score/4 + Robot3Score/8 + Robot4Score/12 + ...) * *random*

(*random* : random number between 0.950 and 1.050)

Winner of a game is determined by calculating individual and team scores of the participant robots. The team with the highest team score wins the game and the prize.

Game	Prize	Score Calculation (for each robot)
RoboChess	200 + NmOfTeams * 25	Intelligence * (HeadDurability/100)
RoboRun	200 + NmOfTeams * 30	Speed * (LegDurability/100)
RoboSumo	250 + NmOfTeams * 35	TorsoForse * (TorsoDurability/100) * 0.7 + LegForce * (LegDurability/100) * 0.3)
RoboPingPong	250 + NmOfTeams * 40	Skill * (ArmDurability/100) * 0.6 + Intelligence * (HeadDurability/100) * 0.2 + Speed * (LegDurability/100) * 0.2

NmOfTeams: The number of teams participate in the game.

Stages of the Games

1. Opening for game registration. The base prizes of 4 games are announced.

2. Players decide to buy/sell modules
   - Build new robots with combining modules
   - Divide robots into their modules

3. Registering robots to the games

4. Game playing. Results are calculated. Prizes are given to the winner team or transferred to the next week for the same game.

5. Durability of the all modules (in robots and on the shelves) is updated.

Commands

```
by hd1          // buy hd1 module
sl m03          // sell module m03
sl r1           // sell all parts of robot r1
++ r2 = hd2 tr1 ar1 lg1  // build new robot r2 (by using newest modules)
++ r3 = tr1 m12 lg1 ar2  // build new robot r3 (by using module m12 and
                                        //      newest modules of others)
-- r1           // divide robot r1 into modules
ch r4 m02       // change related module of robot r4 with module m02

ls 2            // List Team2 robots
rg r2 > c1      // register robot r2 as the first robot of the chess game
                                        //  (c:Chess, r:Run, s:Sumo, p:PingPong)
pl              // play games, list results
```

Sample screens/commands:

```
Week:15  Robot/Credit: T1:3/550  T2:4/300  T3:2/1200  T4:1/600  T5:4/0  T6:5/150
--- Team1: Modules ---
m01.tr1-100     m02.tr3-64      m03.            m04.hd1-98      m05.lg2-76
m06.            m07.            m08.ar1-88      m09.tr2-80      m10.ar2-68
m11.hd1-58      m12.tr1-60      m13.            m14.ar1-100     m15.
m16.            m17.            m18.            m19.            m20.
--- Team1: Robots ---
r1: tr1-60   hd1-88   lg3-74   ar1-100  (Ch:229   Rn:237   Sm:151   Pp:273 )
r4: tr1-100  hd2-60   lg1-100  ar1-100  (Ch:336   Rn:174   Sm:180   Pp:282 )
r5: tr2-80   hd1-54   lg1-60   ar1-80   (Ch: -    Rn: -    Sm: -    Pp: -  )
---Games (Registering)---
Chess: 200      Run: 200      Sumo: 750      PingPong: 250
Team1: r1>r1   r4>c1
--------------------------------------------------------------------------------

Command > ls 3
--- Team3: Robots ---
r1: tr1-100  hd1-90   lg1-100  ar1-100  (Ch:234   Rn:175   Sm:180   Pp:262 )
r2: tr1-100  hd1-100  lg1-100  ar1-100  (Ch:260   Rn:175   Sm:180   Pp:267 )

Command > pl

---Games (Results)---
---RoboChess: 250 (2 teams)
t1-r4: tr1-100  hd2-60   lg1-100  ar1-100  (Ch:336   Rn:174   Sm:180   Pp:282 )
t3-r2: tr1-100  hd1-100  lg1-100  ar1-100  (Ch:260   Rn:175   Sm:180   Pp:267 )
t3-r1: tr1-100  hd1-90   lg1-100  ar1-100  (Ch:234   Rn:175   Sm:180   Pp:262 )
t1 score = (336) * 0.951 = 319.536
t3 score = (260 + 234/4) * 1.047 = 333.469
Winner: Team 3

---RoboRun: 230 (1 team)
t1-r1: tr1-100  hd1-90   lg1-100  ar1-100  (Ch:234   Rn:175   Sm:180   Pp:262 )
t1 score = (237) * 0.984 = 233.208
Winner: Team 1

---RoboSumo: 750 (0 team)
Winner: No winner. Prize transferred to the next week.

---RoboPingPong: 250 (0 team)
Winner: No winner. Prize transferred to the next week.

Command >
```

Suggested Weekly Program

1. Designing and creating the necessary data structures, screen.
2. Designing classes. Parsing commands. by/sl/++/--/ch/ls commands.
3. Prizes, registering, scoring, game results.
4. Computer players AI. Testing and remaining parts of the project.

First Evaluation: 3.3.2017 **Report:** 3.3.2017	**Final Evaluation:** 17.3.2017 (powerpoint + poster) **Report:** 20.3.2017