



OPERAČNÍ PROGRAM PRAHA
ADAPTABILITA



EVROPSKÝ SOCIÁLNÍ FOND

Pogamut 3

Lekce 6 – Steering

PRAHA & EU
INVESTUJEME DO VAŠÍ BUDOUCNOSTI

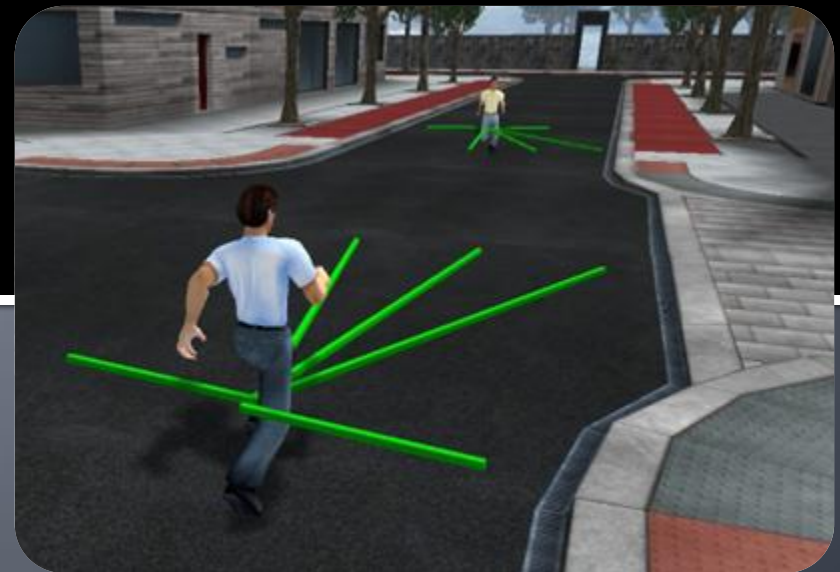
Faculty of mathematics and physics
Charles University at Prague
27th March 2012



UT2004 & UE2 bots made easy!

Pogamut 3

Lecture 6 – Steering Behaviors

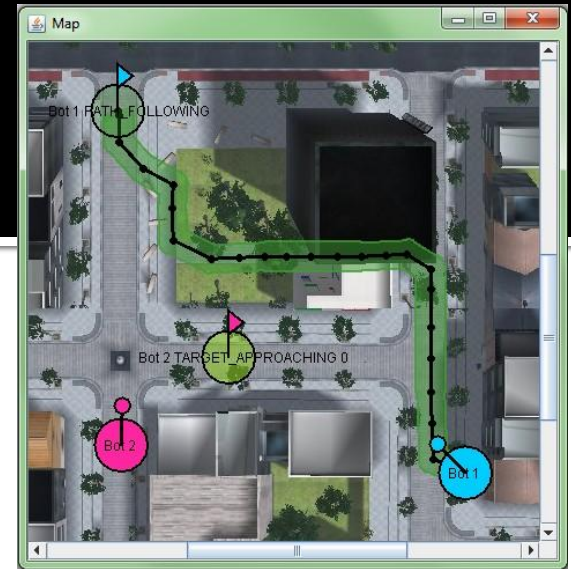


Warm up!

- Quickly fill test for this lesson!

Today's menu

- Steering Tool
- Steering Game
- Steering Library



Steering Tool

- Steering Tool & Steering Game website
 - <http://diana.ms.mff.cuni.cz/pogamut-games/doku.php?id=project:SteeringGame>
- Installer: [SteeringGame 2.0 installer](#)
- Files used in this lesson : [PracticalsScenes](#)
 - http://pogamut.cuni.cz/pogamut_files/misc/SteeringGame/PracticalsScenes.zip

Steering Behaviors Examples

- **Obstacle Avoidance**

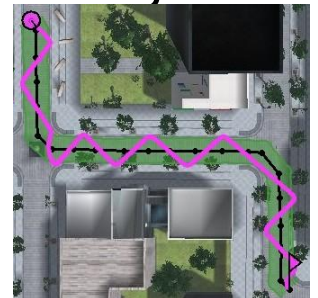
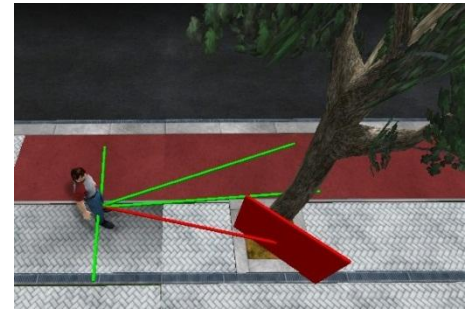
- **Front Collision** – Why and how to solve it?
- **Tree Collisions** – Why and how to solve it?

- **People Avoidance**

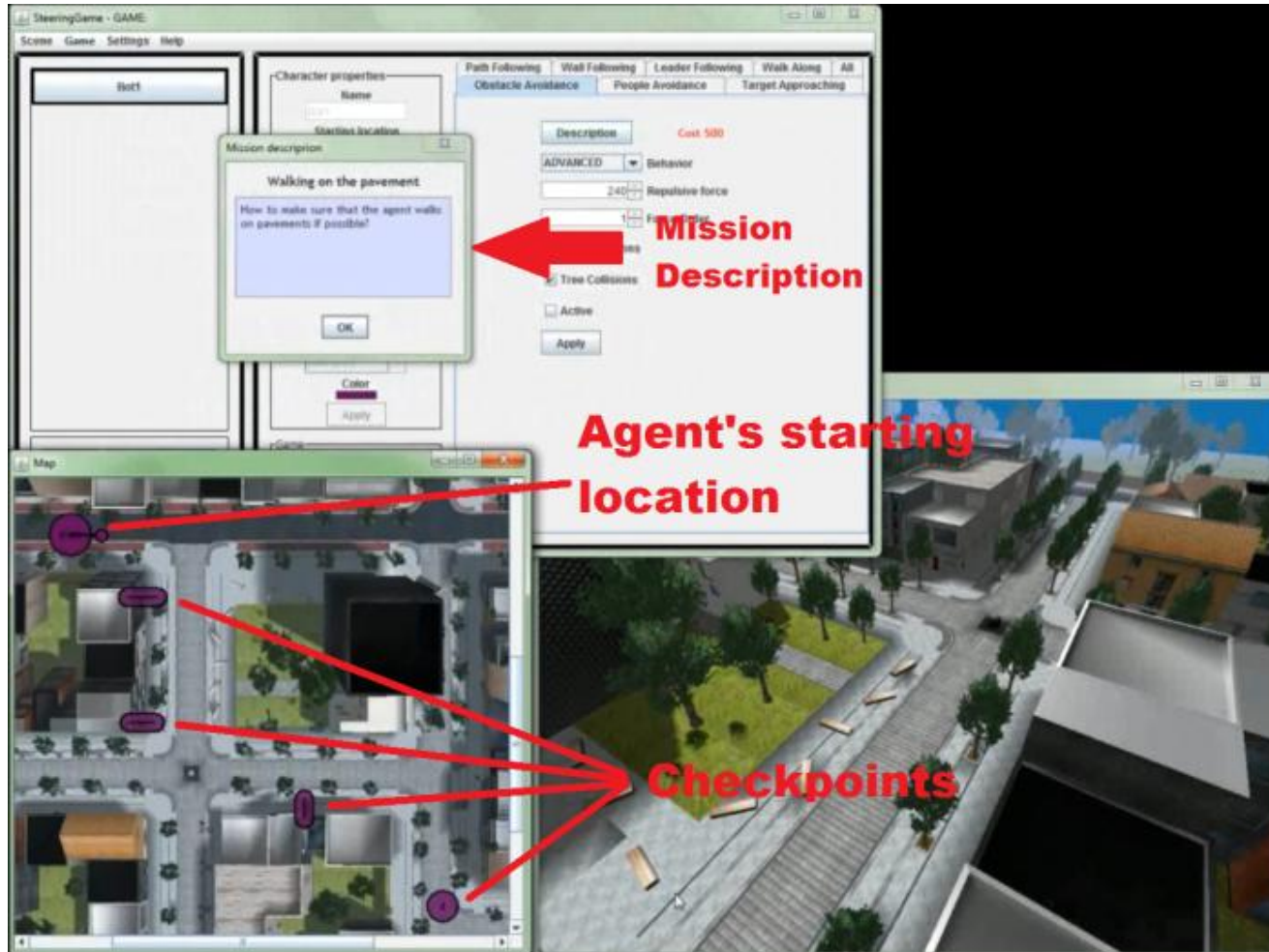
- **Oncoming** – How big has to be the steering force to prevent the collision? How to solve it better?
- **Crossing** – What will happen? Why? How to solve it?

- **Path Following**

- How to improve Path following (smoother trajectory, more natural in curves)? What will be the impact of longer Projection and Regulation Force and why?
- **Regulation Force** – Find the ideal value.



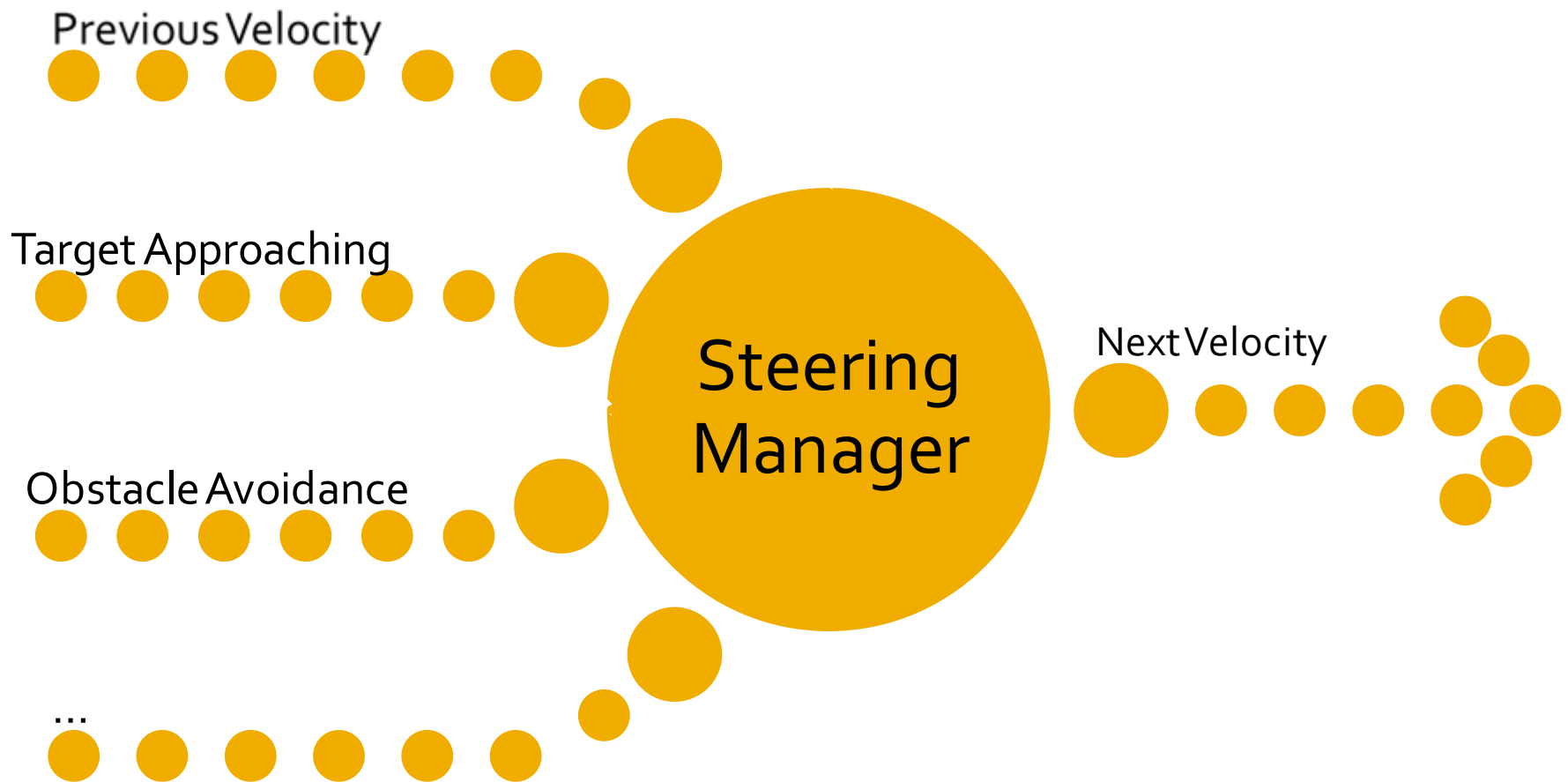
Steering Game



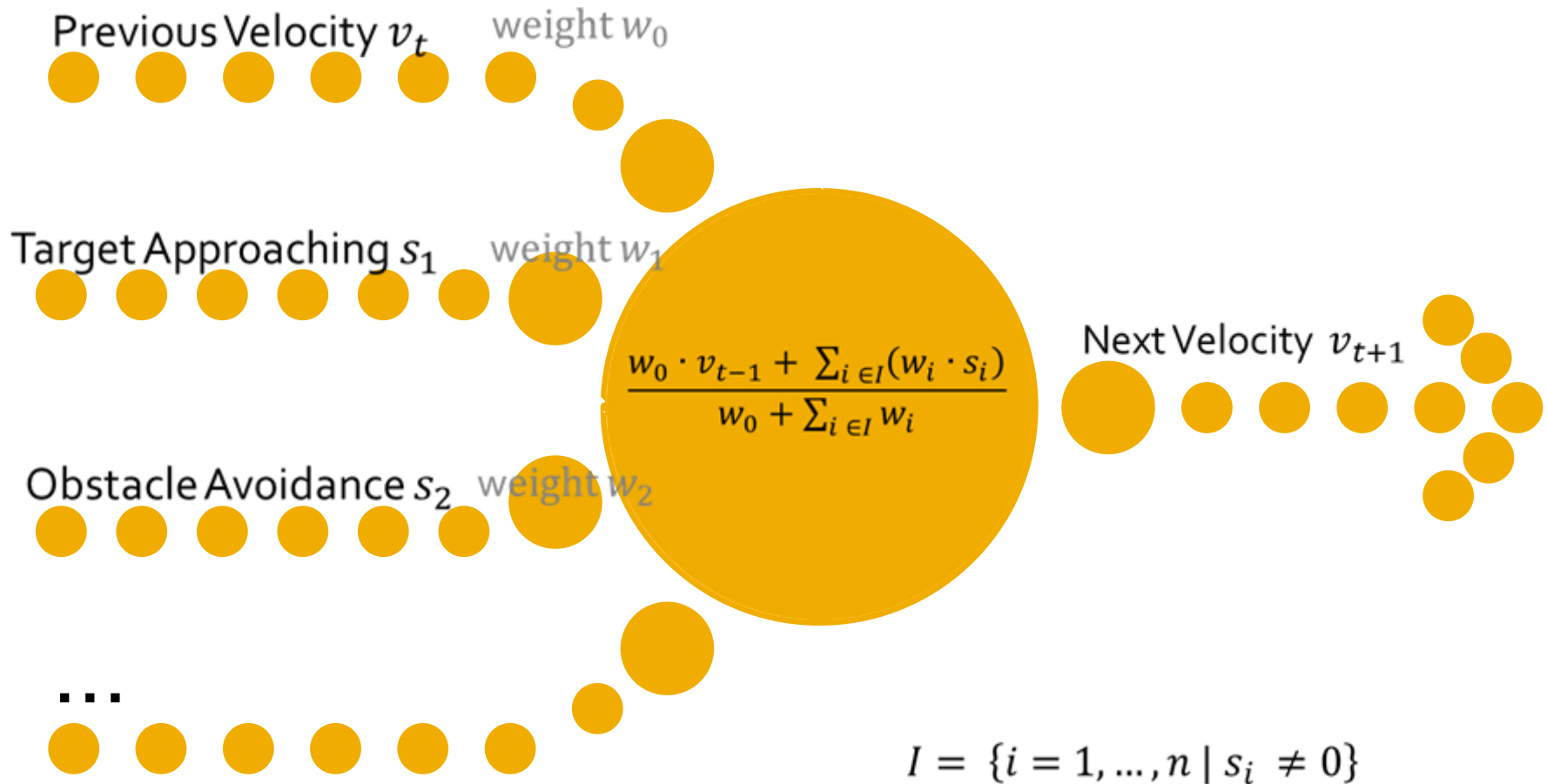
Steering Library

- Download the project EmohawkEmptyBot:
 - http://pogamut.cuni.cz/pogamut_files/lectures/2011-2012/Lecture06-EmohawkEmptyBot.zip
- Before you launch the bot, you need to start UnrealEngine2Runtime server:
 - Go to directory **UnrealEngine2RuntimeDemo/System/** and launch **startEmohawkServer.bat** there.
 - To observe the bot in the environment launch **startUE2Runtime.bat** (after the server is launched).

Steering Library schema



Steering Library schema



Steering Library

- Possible steering behaviors:
 - Target Approaching
 - Obstacle Avoidance
 - Wall Following
 - Path Following
 - Leader Following
 - People Avoidance
 - Walk Along

- Turning navigation on/off:
 - `steering.startNavigation();`
 - `steering.stopNavigation();`
- Adding steering behaviors:
 - `steering.addTargetApproachingProperties(properties);`
 - `steering.addObstacleAvoidanceProperties(properties);`
 - ...
- Other useful methods:
 - `steering.setTargetApproachingProperties(properties);`
 - `steering.removeTargetApproachingProperties(properties);`
 - `steering.clearAllSteerings();`
 - `steering.isTargetApproachingActive();`
 - `steering.getTargetApproachingProperties();`

Steering Library

■ Creating steering behavior properties:

- `prop = new TargetApproachingProperties(attractiveForce, targetLocation); //e.g. force 200;`
- `prop = new ObstacleAvoidanceProperties(SteeringProperties.BehaviorType.ADVANCED));`
- `prop = new WallFollowingProperties(SteeringProperties.BehaviorType.ADVANCED));`
- `prop = new PeopleAvoidanceProperties(SteeringProperties.BehaviorType.ADVANCED));`
- `prop = new LeaderFollowingProperties(SteeringProperties.BehaviorType.ADVANCED));`
 - `prop.setLeaderName(name);`
- `prop = new WalkAlongProperties(SteeringProperties.BehaviorType.ADVANCED));`
 - `prop.setLeaderName(name);`
 - `prop.setTargetLocation(location);`
- `prop = new PathFollowingProperties(SteeringProperties.BehaviorType.ADVANCED));`
 - `prop.setRepulsiveForce(force); //e.g., 200`
 - `IPathFuture path = pathPlanner.computePath(startLoc, targetLoc);`
 - `prop.setPath(path);`
 - `prop.setDistanceFromThePath(distance); //e.g., 200`

Steering Library

■ Useful methods of steering manager:

- `SteeringManager manager = steering.getSteeringManager();`
 - `manager.setDrawRaycasting(true);`
 - `manager.setMultiplier(3);` //bot's velocity will be multiplied by 3 → bot will probably often run
 - `manager.getSteeringForces();` //to see actual computed steering forces
 - etc.



Homework assignment

- Download and install Steering Game
 - [SteeringGame 2.0 installer](#)
- Compulsory (15/100 points)
 - Part A: Solve one level in the Steering Game
 - Part B: Implement SteeringBehaviors-Bot
 - Part C: Fill up the questionnaire
- Bonus (10-40/100 points)
 - Engage in the competitive bonus homework, if you want...

Homework assignment – part A

- Solve one level in Steering Game according to this mapping:
 - $X = \text{Sum of ASCII codes of characters in your surname}$
 - Lower case and without diacritics
 - $Y = X \bmod 14$
 - $\rightarrow$ The value of Y determines the level you should solve:

0 $\rightarrow$ Easy 1	7 $\rightarrow$ Intermediate 1
1 $\rightarrow$ Easy 2	8 $\rightarrow$ Intermediate 2
2 $\rightarrow$ Easy 3	9 $\rightarrow$ Intermediate 3
3 $\rightarrow$ Easy 4	10 $\rightarrow$ Intermediate 4
4 $\rightarrow$ Easy 5	11 $\rightarrow$ Hard 1
5 $\rightarrow$ Easy 6	12 $\rightarrow$ Hard 2
6 $\rightarrow$ Easy 7	13 $\rightarrow$ Hard 3

Example:

Name: Popelová

Characters: popelova

$X = 112 + 111 + 112 + 101 +$
 $+ 108 + 111 + 118 + 97 = 870$

$Y = 870 \bmod 14 = 2$

Level: Easy 3

- After finishing the level, save trajectories of your solution.
- Send us your solution of this level (both _p.xml and _t.xml files).

Homework assignment – part B

- Implement simple SteeringBehaviors-Bot
 - Firstly bot tries to reach his target just going directly to the target (use Target Approaching and Obstacle Avoidance).
 - If bot gets stuck, you should detect it and then plan the path and use Path Following and Obstacle Avoidance to get to the target.
 - Test it in the scene Hard 4, which has these settings:
 - Starting location: x: -2081; y: -9577; z: -3440
 - Starting rotation: pitch: 0; yaw: 6469; roll: 0
 - Target location: x: 2700; y: -4291; z: -3440



Part B – Cheat Sheet

```
public Initialize getInitializeCommand() {
    Location startLoc = new Location(-2081, -9577, -3440);
    Rotation startRot = new Rotation(0, 6469, 0);
    return
        new Initialize()
            .setName("EmohawkEmptyBot")
            .setLocation(startLoc)
            .setRotation(startRot);
}

public void beforeFirstLogic() {
    steering.startNavigation();
    steering.addTargetApproachingSteering(
        new TargetApproachingProperties(100, targetLoc));
    steering.addObstacleAvoidanceSteering(
        new ObstacleAvoidanceProperties(
            SteeringProperties.BehaviorType.ADVANCED));
    SteeringManager sm = steering.getSteeringManager();
    sm.setDrawRaycasting(true);
}
```

Homework assignment – part C

- Please fill up this questionnaire:

<https://docs.google.com/spreadsheet/viewform?formkey=dENGZEIUQ3ZKa1JnZXF2aWRlbDB5OEE6MA>

Bonus HW assignment

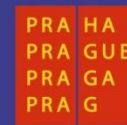
- Try to solve first 4 campaign levels in Steering Game
- Try to find a solution with energy demands as low as possible
- Save your best solutions of first 4 levels (both _p.xml and _t.xml files) and send it to:
 - Markéta Popelová
 - marketa.popelova@matfyz.cz
- Every author of working solutions (of all first 4 levels) will get 10 points.
- The author of best solution (with the lowest used energy in sum) will get extra 30 points!

Send your assignments to

- Completely zip-up your project folder and levels solutions
- Send it to:
 - Markéta Popelová
 - marketa.popelova@matfyz.cz
- Write us how much time you have spent on setting up the Pogamut platform and the assignment respectively!



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DĚKUJI ZA POZORNOST



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