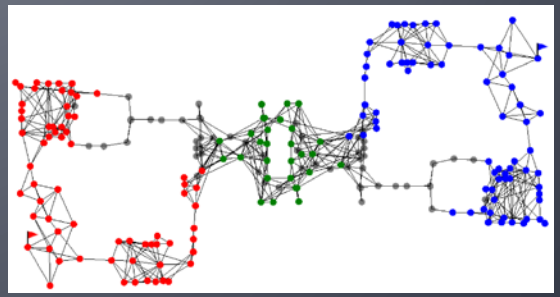
Faculty of Mathematics and Physics
Charles University in Prague
16th May 2016

UT2004 bots made easy!

Pogamut 3

Lecture 12 – Paths & Roles



Warm Up!

- Fill the short test for this lessons
  - 5 minutes limit
  - **https://goo.gl/tpMMvg**
  - **O vs. 0, i vs. l vs. 1**
  - https://docs.google.com/forms/d/1qGGnVitvTzlJHG_moCTGrM2m3ErFkQxgd2u4pYiBSGY/viewform

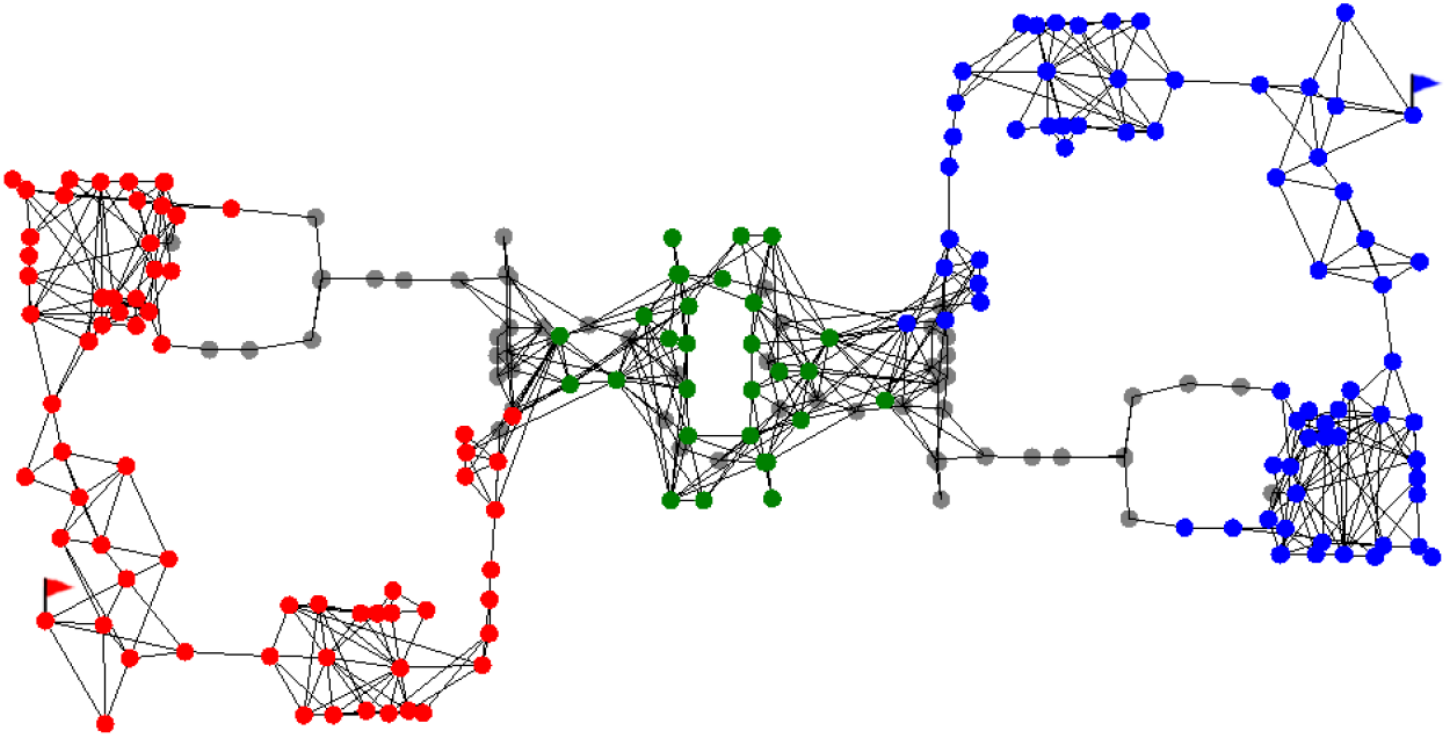
Today's menu

1. Map Division
2. Roles in CTF team
3. Finding different paths within the environment

Map Division

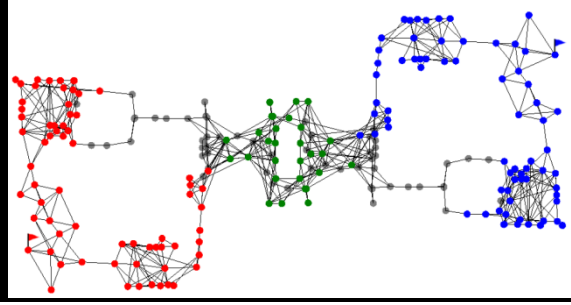
CTF Map

- Red base <-> Mid ground <-> Blue base



Map Division

CTF Map



- Red base <-> Mid ground <-> Blue base

Shorter path to red base:

```
0 <= |Path(RFlag, Point)| / |Path(Point, BFlag)| < 1
```

Shorter path to blue base:

```
0 <= |Path(BFlag, Point)| / |Path(Point, RFlag)| < 1
```

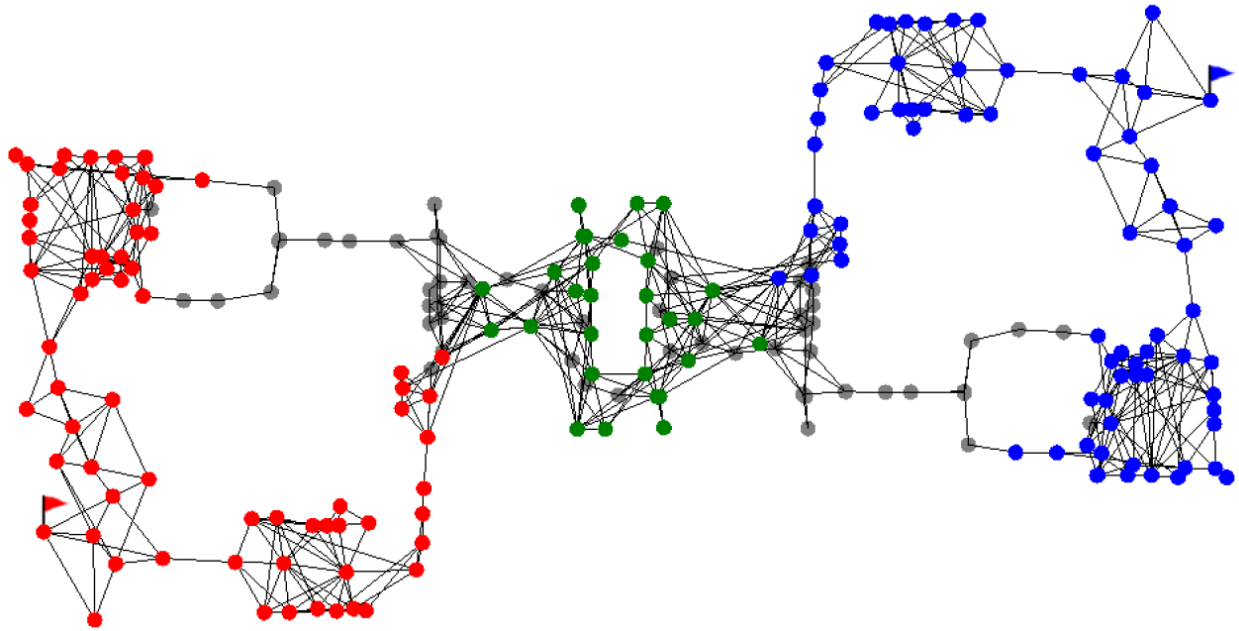
Mid ground:

```
C <= |Path(RFlag, Point)| / |Path(Point, BFlag)| < 1
C <= |Path(BFlag, Point)| / |Path(Point, RFlag)| < 1
```

Map Division

Roles in CTF team

- My base => defender
- Mid ground => roamer
- Enemy Base => attacker



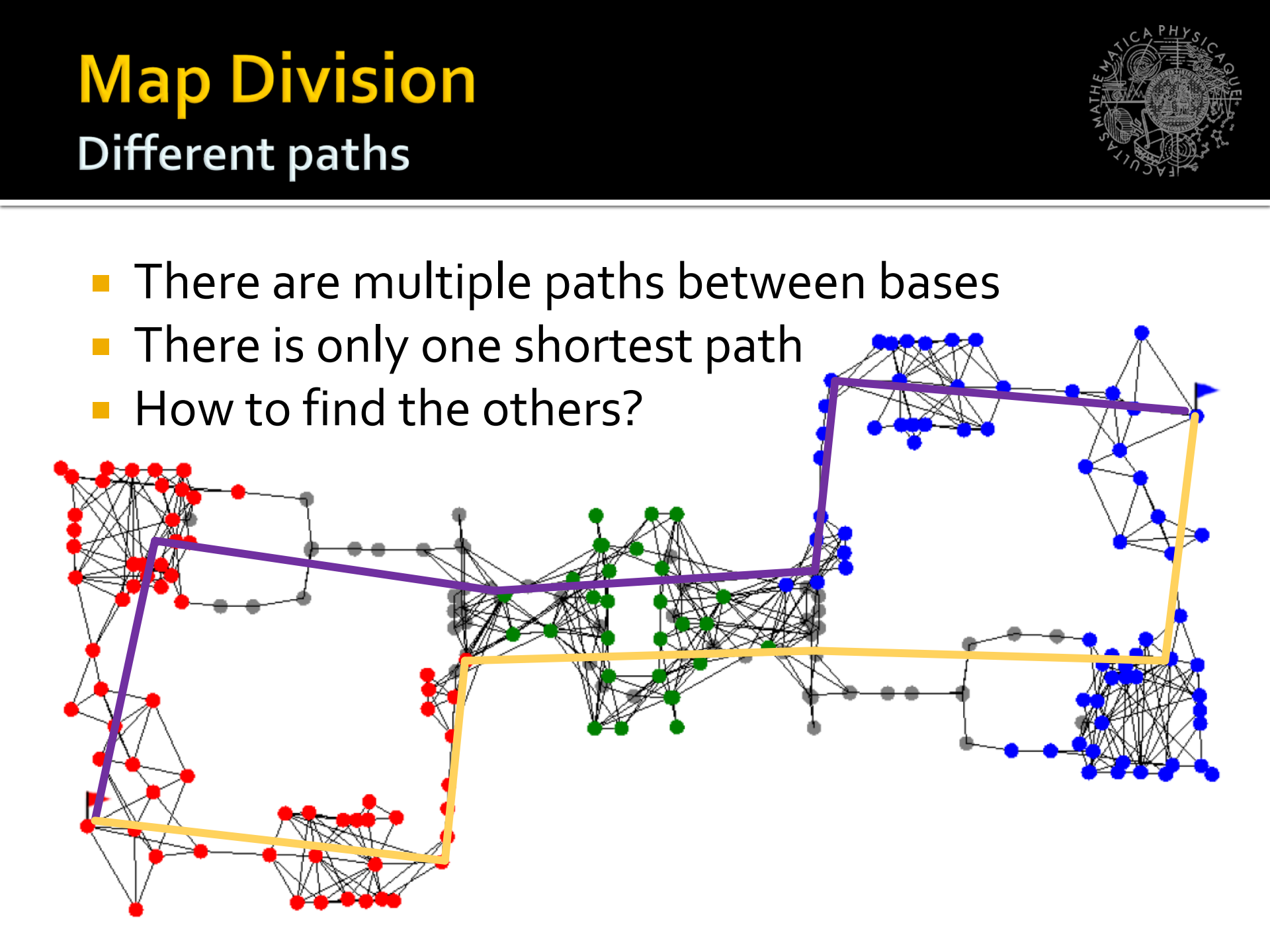
Map Division

Roles in CTF team

- How to synchronize intentions within team?
  - N (cooperating) bots want to perform I; I is m-exclusive
    1. Broadcast score of bot achieving intention I
    2. m-highest (or m-lowest) wins
    - Resend to anyone who wants to join in the middle of execution
- How to decide on strategy?
  - "Group brain" => have a leader that instructs others
  - Establish leader via previous scheme

Map Division

Different paths

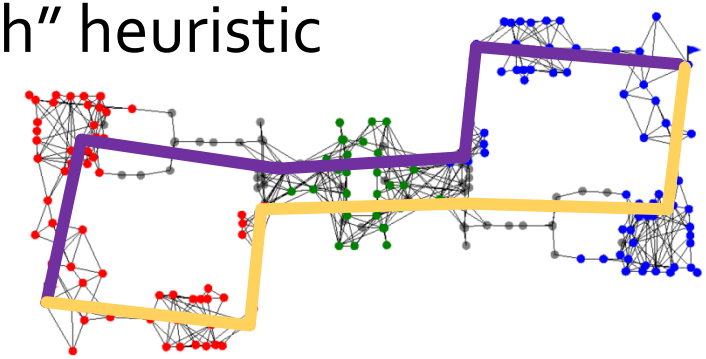


- There are multiple paths between bases
- There is only one shortest path
- How to find the others?

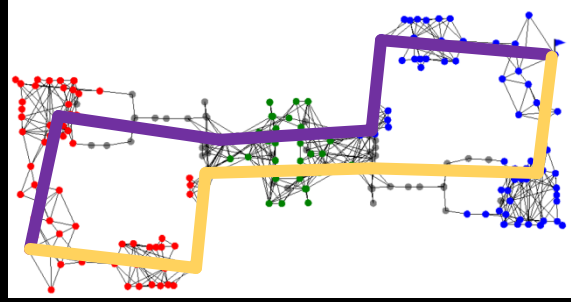
Map Division
Different paths

- Finding k-shortest paths ~ O(m +n log n +kn)
  - David Eppstein
  - G(vertices, edges), |vertices| = n, |edges|= m
  - Problem: too many similar paths ~ k needs to be high
  - Problem: Having k paths, find really different ones
- But we already have Floyd-Warshall matrix

  => We can construct "Different path" heuristic



Map Division
Different paths



- Having FW matrix for G(V, E), |V| = **n**, having **M** paths, find next "different" path?
  - Different == Cost of being too close to some path
- PathsDistance(**point**):
  - Min({ Min({ | path(**point** -> path-**i**-point-**k**) | }$_k$) }$_i$)
  - Can be used for penalization of points during next A*
  - Min({ | path(**point** -> path-**i**-point-**k**) | }$_k$)
  - Can be precomputed time O(n^2)
  - PathsDistance can be incrementally updated
- Time cost of **M+1** different paths O(**M**.n^2) + (**M**+1).A*
  - Typically works in O(n^2)
- Extra space cost O(**n**)
  - For storing PathsDistance(point)

Assignment
(or Homework)

- Create **CTF Team of Bots** in **yaPOSH**
  - CTF Bot from previous two lectures

  +++
  - Include "Guard own flag holder" behavior
    - 5 points
  - Include "Team hunt enemy flag holder" behavior
    - 5 points
  - Include "Run cover path" behavior
    - 5 points
  - Include "Run non-shortest path" behavior
    - 10 points
  - Come up with other CTF-team behavior
    - 10 points
- You may form teams of two people for creating this!

Send us finished assignment

Via e-mail:

- *Subject*
  - "Pogamut homework 2016 – Assignment X"
    - Replace `'X'` with the assignment number and the subject has to be without quotes of course
    - …or face -2 score penalization
- *To*
  - jakub.gemrot@gmail.com
    - Jakub Gemrot (Tuesday practice lessons)
- *Attachment*
  - Completely zip-up your project(s) folder except `'target'` directory and `IDE specific files` (or face -2 score penalization)
- *Body*
  - **Please send us information about how much time it took you to finish the assignment + any comments regarding your implementation struggle**
    - *Information won't be abused/made public*
    - *In fact it helps to make the practice lessons better*
  - Don't forget to mention your full name!

Questions?

I sense a soul in search of answers…

- In case of doubts about the assignment, tournament or hard problems, bugs don't hesitate to contact us!
  - Jakub Gemrot (Tuesday practice lessons)
    - jakub.gemrot@gmail.com