Scenario Week 2
COMP214P

scenario@cs.ucl.ac.uk

11–15 December 2017
Torpe

(the prosperous crab)
How to Furnish a Room
ROTATION!
This Week
Scenario Week 11-15 December 2017

The second Scenario Week is going to be dedicated to an algorithmic challenge involving implementation of mathematical procedures and approaching an open-world optimisation problem.

You will work on the scenario in small teams of 3-4 people. Please, choose your team on the choice page below by Thursday, December 7, 12:00 (noon).

The week will involve a lot of coding and algorithm design, so please, make sure that your team has one or more skilled programmers. You should expect to arrange the workload so different team member would work on different subtasks in parallel, synchronising via a repository. The programming language is not important and the choice is entirely up to you.

The week starts at the Introductory Session at 10am on Monday December 11 in the Darwin Building B40 LT. You must attend this initial session.

Materials for the Scenario Week

- problems.rfp 1.2MB Text file
  A file with Room Furnishing problems
- Room Furnishing Assignment 695.5KB PDF document

Useful Resources

- geometry-intro 1.3MB PDF document
  Geometric Algorithms
- 2d-transform 1.7MB PDF document
  2D Geometrical Transformations (Slides)

Assessment

- Booking a slot for Visualisation Demo, 15 December 2017 (one per team)
- Scenario Week 2 Report
  Not available unless: You belong to any group
- Scenario 4 Group Selection
  Select the group you want to be part of by Thursday, December 7, 12:00 (noon). Groups are of size three or four.
Room Furnishing Problem

Put furniture pieces within a room, without them overlapping, using each item at most once, trying to maximise their overall cost.

• Complexity-wise, harder than
  • SAT
  • Travelling salesman
  • Hamiltonian paths
  • Knapsack problem
Task 1: Computing the best RFP solutions

• 30 instances with obstacles of different shapes;
  • File with instances: problems.rfp (see Moodle page);
  • Room sizes: 4–250 vertices;
  • 40–500 furniture pieces of various shapes;
• Compute a valid set of furniture locations for each problem instance;
• Grading: 60 points, two per instance, for any valid solution.
Encoding of the problems

problems.rfp

1: (0,0), (2,0), (2,1), (1,1), (1,2), (0,2) # 1: (0,0), (1,0), (1,1), (0,1); 2: (0,0), (2,0), (0,1); 3: (0,0), (0.5,0), (0.5,2), (0,2)
A Solution
Encoding your solutions

The format file with the results should start with the first line containing the name of the team and the second line being its password. If those do not match, the file will not be accepted by the system. The remaining lines should contain the solutions in the format, described by the following grammar (white spaces are ignored and can be added arbitrarily):

\[
\text{<solution-instance>} ::= \text{<problem-identifier>} : \text{<location-list>}
\]

\[
\text{<problem-identifier>} ::= \text{<int>}
\]

\[
\text{<location-list>} ::= \text{<furniture-location>} | \text{<furniture-location>} ; \text{<location-list>}
\]

\[
\text{<furniture-location>} ::= \text{<point-sequence>}
\]

\[
\text{<point-sequence>} ::= \text{<point>} | \text{<point>} , \text{<point-sequence>}
\]

\[
\text{<point>} ::= (\text{<double>}, \text{<double>})
\]

A solution for each problem, along with its number, should be placed on a separate line. There is no specific order imposed on the sequence of the paths or solutions. Each solution line starts with a number of a problem, followed by a semicolon, followed by one or more furniture items, separated by semicolons. Each furniture item is a list of points. No unit costs should be mentioned in the solution: they will be retrieved automatically from the problem description.

For instance, a solution (a) from Figure 2 for the problem from Figure 1, containing a triangle and a square, and submitted by the team \text{alarcon} with a password \text{lt239vshrskq} might look as follows:

\text{alarcon}
\text{lt239vshrskq}
1: (2,1), (0,1), (2,0); (0,1), (1,1), (1,2), (0,2)

That is, the initial furniture item (triangle B) encoded as (0,0), (2,0), (0,1) has been rotated and shifted, so in the submitted solution it has become (2,1), (0,1), (2,0) (i.e., (0, 0) has been mapped to (2, 1), (2, 0) to (0, 1), etc). The square A has been shifted by 1 unit vertically, so it is now encoded as (0,1), (1,1), (1,2), (0,2).

Two alternative solutions, (b) and (c) from Figure 2, can be encoded (and submitted separately) as:
Checking and submitting solutions

- **Warning:** *double-precision floating-point* arithmetic
  - all equalities are up to $\varepsilon = 0.000,000,001$
- Details on acceptance criteria are in the *specification* (on Moodle)
- Submit your solutions here:

http://scenario.cs.ucl.ac.uk

Solutions are accepted until 14:00 GMT 15 Dec 2017
Task 2: Visualisation

• Implement a visualiser for rooms and furniture locations:
  • drawing room shapes;
  • showing by colour different unit costs of furniture items;
  • drawing remaining unused furniture;
  • drawing selected furniture items within the room.

• Grading: 10 points

• Assessed by the organisers from 14:00 till 17:00, 15 Dec

• book a slot for your team!
Our Solution (intentionally suboptimal)

- Room size: 9
- 39 furniture pieces
- Coverage: 40%
Our Solution (intentionally suboptimal)

- Room size: 180
- 500 furniture pieces
- Coverage: 46%
Task 3: Implementation report

• Describe your implementation experience
  • language, tools, algorithms, heuristics, etc.
  • details in the specification (see Moodle)

• Grading: 10 points

• Submit on Moodle by 17:00, 15 Dec 2017 (one per team)
Task 4: The Competition!

• Compete with other teams for the best RFP solutions
• Check the score table [http://scenario.cs.ucl.ac.uk](http://scenario.cs.ucl.ac.uk) for details
• Grading: up to 20 points.

\[ \text{Reward} \ (\text{team}) = 20 - \min(20, \text{rank} \ (\text{team}) - 1) \]
# Overall grading

<table>
<thead>
<tr>
<th>Task</th>
<th>Max grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computing valid RFP solutions</td>
<td>60</td>
</tr>
<tr>
<td>Visualisation of the solutions</td>
<td>10</td>
</tr>
<tr>
<td>Implementation report</td>
<td>10</td>
</tr>
<tr>
<td>The Competition</td>
<td>20</td>
</tr>
</tbody>
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This week schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday 11 Dec</th>
<th>Tuesday 12 Dec</th>
<th>Wednesday 13 Dec</th>
<th>Thursday 14 Dec</th>
<th>Friday 15 Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00-11:00</td>
<td>Darwin Building B40 LT</td>
<td>Darwin Building B15</td>
<td>Student Central - 1st Floor - The Venue</td>
<td>IOE - Bedford Way (20) - 802</td>
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<tr>
<td>11:00-12:00</td>
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<tr>
<td>12:00-13:00</td>
<td>Gordon House 106</td>
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<tr>
<td>14:00-16:00</td>
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<td>IOE - Bedford Way (20) - 104 - Elvin Hall</td>
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<tr>
<td>16:00-17:00</td>
<td>Medawar Building G02 Watson LT</td>
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<td>Birkbeck Malet Street B36</td>
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<tr>
<td>17:00-18:00</td>
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<td>IOE - Bedford Way (20) - 104 - Elvin Hall</td>
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Helpdesk (green) — time and location where the staff and/or TAs will be present to answer your questions
Lectures (blue) — introductory and concluding lectures
Demonstration (red) — checking the visualisation of the algorithms by the staff and TAs (book your slot!)
Good luck!