Optional Programming Exam

Due date: December 11, 2016 at 11:59PM

Notes:

- This exam is an optional exam for improving the midterm exam marks.
- This exam's grade will be counted as 20% bonus over the obtained grade in the midterm exam. For example, if your midterm exam mark is 70% and you obtained 80% in this programming exam, your midterm exam mark will be (70+80/100*20=70+16=86%).
- This exam is a group exam. The group SHOULD be same group as course project.
- Make sure you installed ROS and configured your workspace as explained in the tutorials.
- Get CatBot ROS package from SPC418 GitHub Repo: https://github.com/spc418-ZC/SPC418-Fall-2016
- Anything handed in after the due date will be penalized by 50% for each 24 hours of lateness.

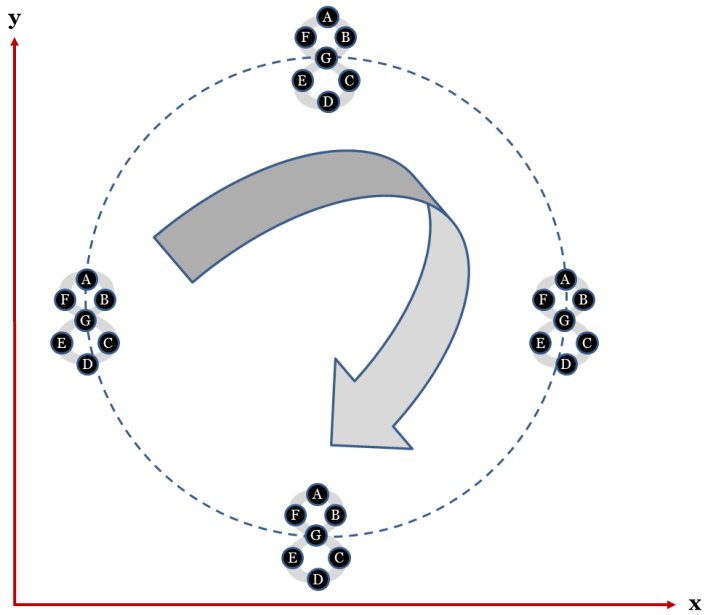
What to submit: a report that contains:

- ROS-compatible code and a README file.
- Zip the source code and the README file and name it "**ProgExam-Your Project#.zip**".
- Send this file to the course TA, Eng. Ahmed Khairy.

MRS Group Formation

Multi-robot systems (MRS) are a group of robots that are designed aiming to perform some collective behavior. By this collective behavior, some goals that are impossible for a single robot to achieve become feasible and attainable. There are various foreseen benefits of MRS compared to single robot systems such as resolving task complexity, increasing the performance, increasing reliability and simplicity in design. Group formation is one of the benchmark problems to study MRS. Group formation has permitted sophisticated behaviors that would have never been achievable by individual members. These behaviors include, but are not limited to, cooperative foraging, defense, search or exploration. Most of the group formation techniques force the members of the group to move in a cohesive way as a whole. Nowadays, there are many applications deploying the group formation techniques e.g. sphere bush, fire control, surveillance and under water exploration.

Build a ROS simulation that renders the group formation of 7 CatBot robots able to form your project number. For example, if you project number is 8, the seven robots (A, B, C, D, E, F, G) will position themselves to form the number 8 as illustrated below.



Use rviz to animate the motion of the robots following a circular trajectory and keeping the same group formation while they are moving. Show the motion for a complete circle. A circle is defined in *x-y* Cartesian coordinate system by the following equations:

$$x(\theta) = R\cos(\theta)$$

$$y(\theta) = R\sin(\theta)$$

where R is the radius of the circle (you can assume it) and θ is the angle of rotation (initial position: $\theta=0$ and final position: $\theta=2\pi$]. You can segment the circle as many times as you want. The more segments you use, the smoother the trajectory will be.