ZERO ROBOTICS
ISS PROGRAMING CHALLENGE

Mission: Launch SPS devices to find most accurate assembly zone to build a satellite. This satellite will be able to find the best locations on Mars to build homes!

Mission update: Oh no! A rival company is also trying to build satellites to go to Mars. Whoever builds the satellites the fastest will get the contract! Be careful! The other company may get the satellite pieces you've already collected!

Students will: collect small, medium, and large satellite pieces and drop inside their assembly zone (the ideal place to build satellites)

Online Game overview:
1. **SPS:** Each team will be given 3 SPS to form a triangle in order to find their assembly zone.
   *In online game- if the SPS pieces are too close together, it will not allow you to drop it off. The area of the triangle must be larger than ____ m^2 (The online game has not determined this size yet)

2. **Assembly zone:** This is kept secret during the planning phase and during the game. Once all 3 pieces are placed, you can use the zone function (online game) to find the zone.

3. **Points:** You will get points by how many seconds your items (small, medium, and large) are in the assembly zone.
   a. To pick up items, you must stop and dock on the correct side (docking side) of the item
   b. You will know the positions of the docking side and items beforehand so that you can plan accordingly.

4. **Winning:** In order to win, teams need to place their 3 SPS pieces, dock satellite items to place in their zones, all while managing their fuel, time, and location.

Acting out the Game:
1. Teams have 10 minutes to come up with a strategy and assign roles.
2. Game has 15 increments with 5 actions each (75 total actions)
3. Actions: Move one square, rotate 90 degrees, drop items, attempt to dock (dropping SPS while moving does not count as an action)
   ex: Move forward 3 squares, turn 90 degrees to the right, and attempt to dock= 5 actions
4. SPSs must be dropped an area no less than 8 square units
       i. 4x4= 8 sq.units (8 steps)
       ii. 3x6=9 sq. units (9 steps)
       iii. 2x8=8 sq. units (8 steps)
   b. when dropping the last SPS, referee will let team know if triangle is valid. If the area is not large enough, team cannot drop it.
   c. Once SPS is placed and area is large enough, the referee will tell the team the location of the assembly zone.

5. Docking: With small or medium item→ SPHERE must be in square adjacent to dock face and must be facing satellite.

    a. Large item→ must be 2 squares away and facing the dock side.

    b. Docking is its own action. Must use this as action in the increment.

6. Items: items cannot be picked up until it has been dropped.

    * if 2 SPHERES arrive to same square at the same time to pick up an item:

- Neither team collects
- Each SPHERE must move one square to the right
- Each team gets collision penalty

    a. Items can be picked up as many times as possible as long as it's not being held by opposing SPHERE.

7. Scoring & Penalties:

    a. Gain points by: size of item in assembly zone/increment that it remains there.

    b. Points based on size of triangle

      i. Ex: 4x4 right triangle will receive $0.1*((1/2)*(4x4)=0.8$ points

    c. Penalties:

      i. Both SPHERES enter the same square

      ii. SPHERES enter an opponent's assembly zone (after an entire increment has been completed)

      iii. SPHERES enter same space as small, medium, or large item

      iv. SPHERES enter the same square as an SPS item

8. Determining the Assembly Zone: Assembly zone keeper will roll 2 dice. 1-6 and A-F will be set up on the grid.

      1st dice: 1, 2, 3, 4, 5, 6,

      2nd dice:

        1=A

        2=B

        3=C

        4=D

        5=E

        6=F

- Zones will be mirrored. Therefore, the dice are rolled once and the assembly zone is the same for both teams.
- Referee will also need to determine if the triangle area is large enough by using the formula:

      A= ½*base*height