# Autonomous Maze *(CEENBoT Hopscotch)*: GPI, TI, or API

Objective: Autonomous programming of the CEENBoT. The CEENBoT has to visit each numbered hopscotch space, in numerical order, and return to start each time.

Rules

1. All course challenges must be completed in <u>five minutes</u> for full credit.
2. Participants may modify ("engineer") their CEENBoT to assist in completion of the challenge.
3. Participants will be given the exact dimensions of the course and the challenges prior to the event so that their respective CEENBoT can be programmed to complete the specific challenge (see Figure 1).
4. The CEENBoT must begin below the "1" hopscotch "tile" for each challenge.
5. All three CEENBoT wheels must to be clearly inside the applicable hopscotch tile to receive the respective hopscotch tile's points before its return to complete the challenge. Each hopscotch tile that is passed through to get to the next sequentially numbered tile also has to have all three CEENBoT wheels in the hopscotch tile (that is, it cannot touch the lines of an adjacent hopscotch tile other than the next sequential hopscotch tile.
6. Participants will be allowed to restart the course as many times as they can during the allotted time.
7. The best score and fastest time will be used for final scoring and ranking.
8. All wheels must remain in contact with the ground (Judges' discretion).
9. Once the CEENBoT begins a challenge ("hop"), it should not be touched.
10. If the participant chooses to move the robot for a slight route adjustment, the student must first inform the judge of the adjustment.
11. For each adjustment, the following penalties will be enforced:

    ➢ 1st course adjustment - 20 sec. penalty
    ➢ 2nd course adjustment - 30 sec. penalty
    ➢ 3rd course adjustment - start over (without time stoppage)

12. Only if due to a "start over" and the participants' choice to "scratch" the challenge attempt, the participants will have the opportunity to complete the challenge *after all teams have had the opportunity to complete the challenge*. This depends on if time permits in the competition portion of the Expo.

Figure 1. CEENBoT Hopscotch (one course, 10' x 10' area (1' x 1' spacing))
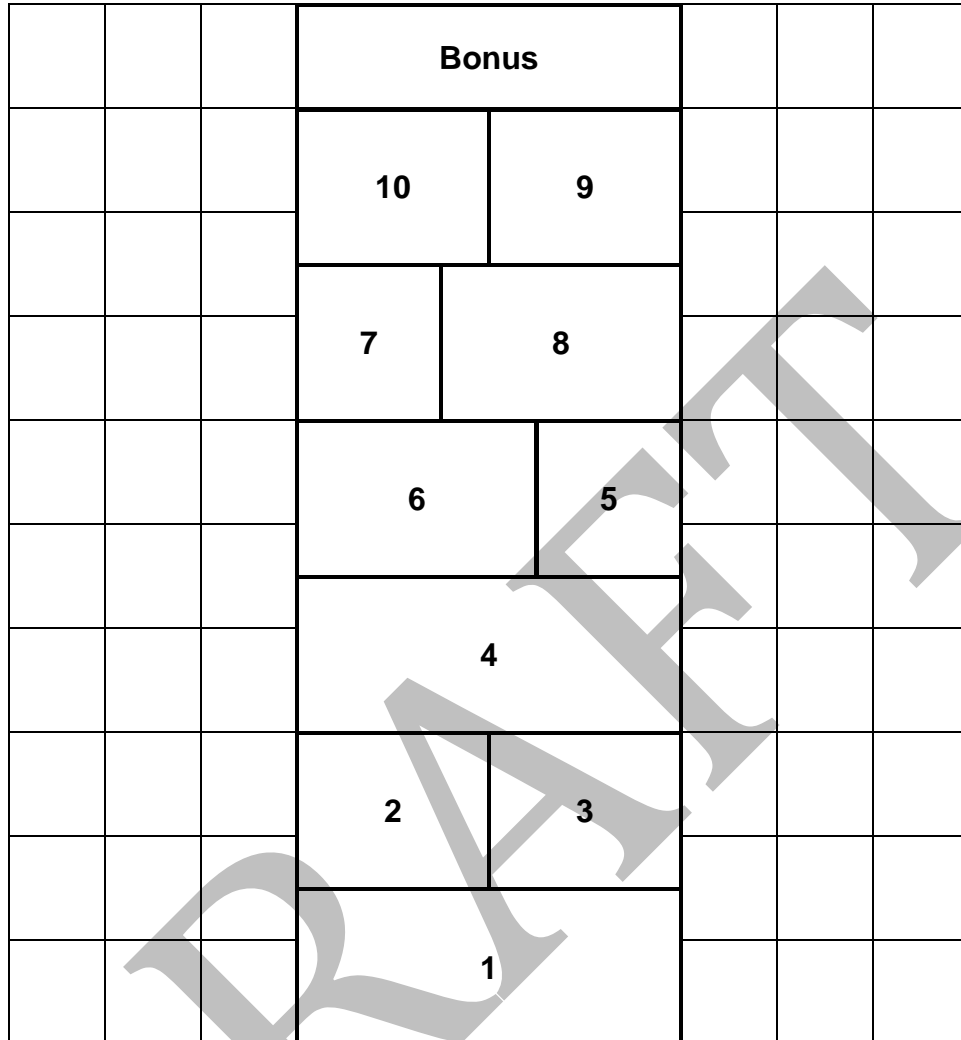
Hopscotch Sandbox (Elementary Level):

1. This challenge requires precision completion of the hopscotch course (see Figure 1).
2. The CEENBoT must complete the hopscotch course sequentially through to the "BONUS".
   a. The CEENBoT must start its "hop" below tile "1", go to tile "1" (all three wheels within tile), and return to its starting point.
   b. Then, the CEENBoT must start its second "hop" below tile "1", go to tile "1", then tile "2", (all three wheels within tile), and return to its starting point in a descending sequential order (e.g., Start, 1, 2, 1, Start).
   c. Then, the CEENBoT must start its third "hop" below tile "1", go to tile "1", then tile "2", then tile "3" (all three wheels within tile), and return to its starting point in a numerically descending order (e.g., Start, 1, 2, 3, 2, 1, Start).

d. This will be repeated, in the previous manner, until the course is completed ("Bonus"), or time expires.

NOTE 1: CEENBoT Commander can store up to eight (8) programs. Consider using a delay command upon return, or engage the pause button, to position CEENBoT for next "hop".

3. Points will be awarded respective to the tile value successfully completed on a particular "hop" and return. That is, Tile 1 = 1 point, Tile 2 = 2 points, Tile 3 = 3 points, etc.
4. BOUNS deducts one (1) minute from final elapsed time.
5. The clock will stop once the CEENBoT successfully returns to the Start after reaching BONUS.
6. Scoring is based on total points, as well as time to complete the hopscotch course.
7. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.

Hopscotch Blacktop (Middle Level):

1. This challenge requires precision completion of the hopscotch course (see Figure 1).
2. The CEENBoT must complete the hopscotch course sequentially through to the "BONUS".
   a. The CEENBoT must start its "hop" below tile "1", go to tile "1" (all three wheels within tile), and return to its starting point.
   b. Then, the CEENBoT must start its second "hop" below tile "1", go to tile "1", then tile "2", (all three wheels within tile), and return to its starting point in a descending sequential order (e.g., Start, 1, 2, 1, Start).
   c. Then, the CEENBoT must start its third "hop" below tile "1", go to tile "1", then tile "2", then tile "3" (all three wheels within tile), and return to its starting point in a numerically descending order (e.g., Start, 1, 2, 3, 2, 1, Start).
   d. This will be repeated, in the previous manner, until the course is completed ("Bonus"), or time expires.

   NOTE 1: CEENBoT Commander can store up to eight (8) programs. Consider using a delay command upon return, or engage the pause button, to position CEENBoT for next "hop".

3. Points will be awarded respective to the tile value successfully completed on a particular "hop" and return. That is, Tile 1 = 1 point, Tile 2 = 2 points, Tile 3 = 3 points, etc.
4. BOUNS deducts one (1) minute from final elapsed time.
5. **Students will have to engineer an apparatus to deliver the hopscotch "rock" to the designated hopscotch tile.**
   a. **Tile 4 = 1 point**
   b. **Tile 6 = 2 points**

      c. **Tile 8 = 3 points**
      d. **Tile 10 = 4 points**

6. Hopscotch "rocks" will be constructed of two ¾" PVC plugs and one ¾" PVC coupling (FPTxFPT) and filled with sand. The plugs will be screwed into the ends of the coupling.
7. The clock will stop once the CEENBoT successfully returns to the Start after reaching BONUS.
8. Scoring is based on total points, as well as time to complete the hopscotch course.
9. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.

Hopscotch Hardcourt (High School Level):

1. This challenge requires precision completion of the hopscotch course (see Figure 1).
2. The CEENBoT must complete the hopscotch course sequentially through to the "BONUS".
      a. The CEENBoT must start its "hop" below tile "1", go to tile "1" (all three wheels within tile), and return to its starting point.
      b. Then, the CEENBoT must start its second "hop" below tile "1", go to tile "1", then tile "2", (all three wheels within tile), and return to its starting point in a descending sequential order (e.g., Start, 1, 2, 1, Start).
      c. Then, the CEENBoT must start its third "hop" below tile "1", go to tile "1", then tile "2", then tile "3" (all three wheels within tile), and return to its starting point in a numerically descending order (e.g., Start, 1, 2, 3, 2, 1, Start).
      d. This will be repeated, in the previous manner, until the course is completed ("Bonus"), or time expires.

      NOTE 1: CEENBoT Commander can store up to eight (8) programs. Consider using a delay command upon return, or engage the pause button, to position CEENBoT for next "hop".

3. Points will be awarded respective to the tile value successfully completed on a particular "hop" and return. That is, Tile 1 = 1 point, Tile 2 = 2 points, Tile 3 = 3 points, etc.
4. BOUNS deducts one (1) minute from final elapsed time.
5. **Students will have to engineer an apparatus to retrieve the hopscotch "rock" to the designated hopscotch tile using a servo motor(s).**
      a. **Tile 4 = 1 point**
      b. **Tile 6 = 2 points**
      c. **Tile 8 = 3 points**
      d. **Tile 10 = 4 points**
6. Hopscotch "rocks" will be constructed of two ¾" PVC plugs and one ¾" PVC coupling (FPTxFPT) and filled with sand. The plugs will be screwed into the ends of the coupling.

7. The clock will stop once the CEENBoT successfully returns to the Start after reaching BONUS.
8. Scoring is based on total points, as well as time to complete the hopscotch course.
9. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.

Please note: *Robots cannot have in use any modification that can damage equipment, other robots, and/or the playing field.*

Judges rules are final and not subject to review.