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

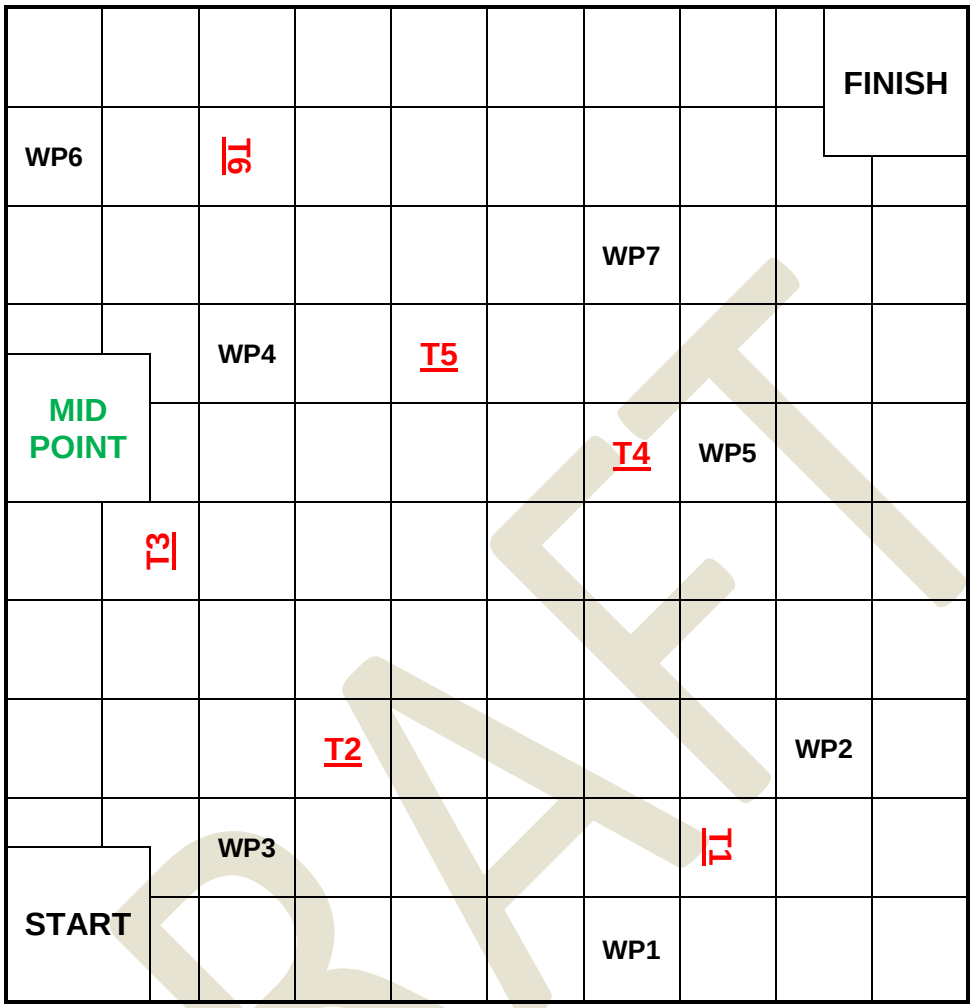
Objective: Autonomous programming of the CEENBoT. The CEENBoT has to complete the given course as directed by numerically-ordered waypoints in addition to striking numbered targets.

Rules

1. All course challenges must be completed in five minutes for full credit.
2. Participants may modify ("engineer") their CEENBoT to meet the objective.
3. Participants will be given the exact dimensions of the course and their respective challenge prior to the event so that their CEENBoT can be programmed to complete the specific challenge (see Figure 1).
4. The CEENBoT must begin within "START" for each challenge (see Figure 1).
5. All three CEENBoT wheels must remain within the outer boundary of the challenge space (see Figure 1).
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, it should not be touched.
    a. If the participant chooses to affect ("touch") the CEENBoT for a route adjustment, the student must first inform the judge of the adjustment.
    b. Each adjustment will result in the following penalties:
        . 1st course adjustment - 20 seconds added to final time
        . 2nd course adjustment - 30 seconds added to final time
        . 3rd course adjustment – Start over (without time stoppage)
10. 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 their respective challenges*. This depends on if time permits in the competition portion of the Nebraska Robotics Expo.

Note 1: Numbered "targets" will be constructed of one 9 oz plastic drinking cup, one table tennis ball, one standard plastic drinking straw (approx. 2 in.), and one 4 in. (dia.) "bull's eye" target (see Figure 2). The drinking cup, ball, and straw will be attached to one another with modeling compound (e.g., Play-Doh). The center of the "bull's eye" target will be 6.5 in. above floor level. Numbered "Targets" will be clearly marked and centered in each designated square's coordinates (see Figure 1). The event course's boundary and designated squares will be outlined. *Gridlines will not be provided on event course.*

Figure 1. CEENBoT Biathlon. [one course, 10' x 10' area (1' x 1' spacing)]



Legend (See Note 1)
T1 – Target #1 (line denotes front of target) (See Figure 2).

WP1 – Way Point #1

Figure 2. Numbered Target

Front View **Rear View**

Biathlon Individual (Elementary Level):

1. This challenge requires precision completion of the biathlon course (see Figure 1).
2. Completion of the course requires the CEENBoT begin at "START", travel to each waypoint (WP) in numerical order (i.e., WP1, WP2, WP3, and so on), and stop at "FINISH".
    a. The CEENBoT must have all wheels pass within the one square foot area of each respective waypoint.
3. Five (5) points will be earned for each waypoint reached (see 2.a).
4. One (1) point will be earned for each consecutive waypoint reached (i.e., WP1 to WP2 earns 1 point, WP2 to WP3 earns 2 points, and so on).
5. The "MIDPOINT" serves as a "refresh area/pit stop". In the "MIDPOINT", a CEENBoT can:
    a. Be positioned to complete the remainder of the course.
    b. Utilize an additional program.
    c. Note: the clock will continue to run.
6. Final time will be the time necessary to complete the course, if less than five minutes (5 min.).
7. *A Bonus five (5) points will be awarded for completing the course in the allotted five minutes.*
8. *One (1) point will be deducted for each contact with a target (e.g., T1, see Figure 1).*
9. Scoring is based on total points. A maximum of 46 points is possible.
10. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.

Biathlon Sprint (Middle Level):

1. This challenge requires precision completion of the biathlon course and striking numbered targets (see Figure 1).
2. **Students will have to engineer an apparatus to strike a numbered target (e.g., T1) using a servo motor.**
3. Completion of the course requires the CEENBoT begin at "START", travel to each waypoint (WP) in numerical order (i.e., WP1, WP2, WP3, and so on), strike numbered targets in numerical order (i.e., T1, T2, and so on). and stop at "FINISH".
    a. The CEENBoT must have all wheels pass within the one square foot area of each respective waypoint.
    b. The CEENBoT must strike the numbered target on the front of the designated "bull's eye" (see Note 1 and Figure 2).
4. The "MIDPOINT" serves as a "refresh area/pit stop". In the "MIDPOINT", a CEENBoT can:
    a. Be positioned to complete the remainder of the course.
    b. Utilize an additional program.
    c. Note: the clock will continue to run.
5. Five (5) points will be earned for each waypoint reached (see 3.a.).
6. Five (5) points will be earned for each numbered target's "bull's eye" struck.

7. One (1) point will be earned for each consecutive waypoint reached (i.e., WP1 to WP2 earns 1 point, WP2 to WP3 earns 2 points, and so on).
8. Final time will be the time necessary to complete the course, if less than five minutes (5 min.).
9. *A Bonus five (5) points will be awarded for completing the course in the allotted five minutes.*
10. *One (1) point will be deducted for each contact with a numbered target other than its respective "bull's eye" (e.g., T1, see Figure 1).*
11. Scoring is based on total points. A maximum of 76 points is possible.
12. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.

Biathlon Pursuit (High School Level):

1. This challenge requires precision completion of the biathlon course and striking numbered targets (see Figure 1).
2. **Students will have to engineer an apparatus to <u>project an object</u> to strike a numbered target (e.g., T1) using an electromechanical device (i.e., utilizes a trigger, timer, sensor, etc.).**
3. Completion of the course requires the CEENBoT begin at "START", travel to each waypoint (WP) in numerical order (i.e., WP1, WP2, WP3, and so on), strike numbered targets in numerical order (i.e., T1, T2, and so on). and stop at "FINISH".
    a. The CEENBoT must have all wheels pass within the one square foot area of each respective waypoint.
    b. The CEENBoT must strike the numbered target on the front of the designated "bull's eye" (see Note 1 and Figure 2).
4. Five (5) points will be earned for each waypoint reached (see 3.a.).
5. Five (5) points will be earned for each numbered target's "bull's eye" struck.
6. One (1) point will be earned for each consecutive waypoint reached (i.e., WP1 to WP2 earns 1 point, WP2 to WP3 earns 2 points, and so on).
7. The "MIDPOINT" serves as a "refresh area/pit stop". In the "MIDPOINT", a CEENBoT can:
    a. Be positioned to complete the remainder of the course.
    b. Utilize an additional program.
    c. Load projectiles.
    d. Note: the clock will continue to run.
8. Final time will be the time necessary to complete the course, if less than five minutes (5 min.).
9. *A Bonus five (5) points will be awarded for completing the course in the allotted five minutes.*
10. *One (1) point will be deducted for each contact with a numbered target other than its respective "bull's eye" (e.g., T1, see Figure 1).*
11. Scoring is based on total points. A maximum of 76 points is possible.
12. Total points determine the leader, with the fastest completion time determining ranking and tiebreakers.