



# 2010 UOIT Engineering Robotics Competition

## CIRCUS MAXIMUS

### Goal

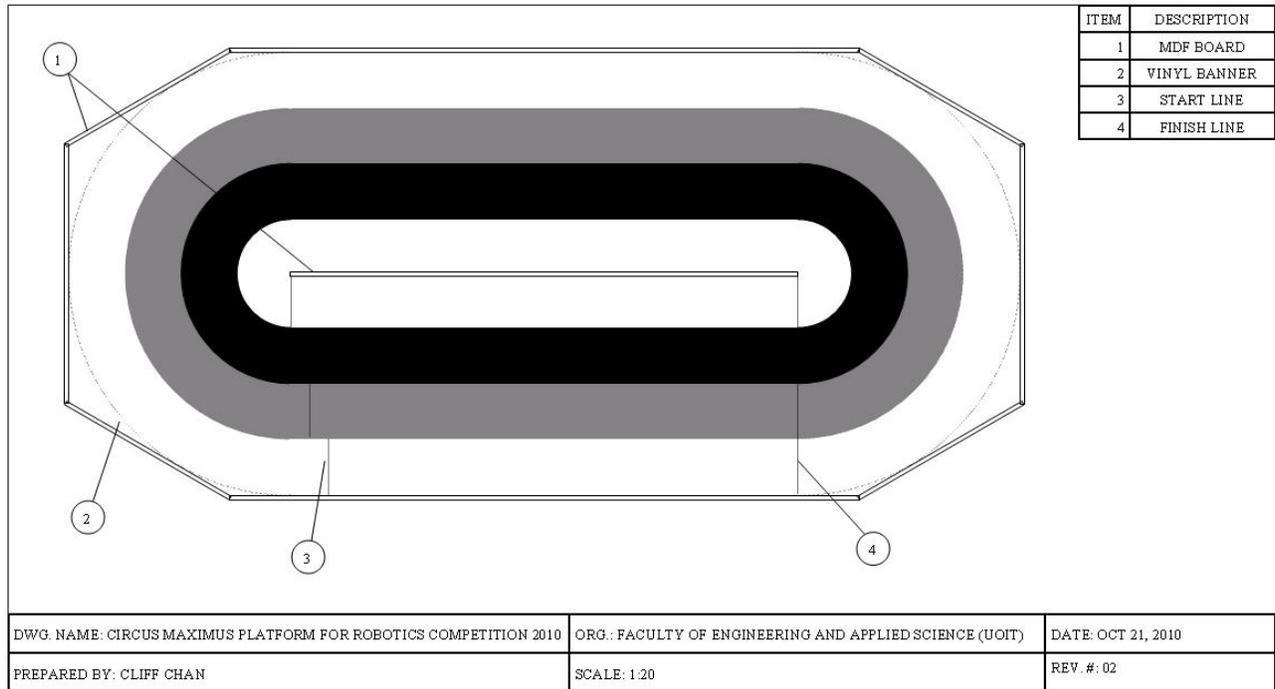
Each team will design an autonomous Chariot that will race the opposition around a track in head-to-head competition with no restrictions on lanes or prevention of contact between the Chariots. Four (4) Chariots will compete at the same time.

Each team is required to submit a short technical report documenting their design. This is due Tuesday November 30<sup>th</sup> by 5:00 pm and is to be submitted electronically.

### Circus Maximus Track

The track for the competition is shown in Figure 1 and has the following characteristics:

- The track is a flat loop that is approximately 15' by 7' in size.
- The table is painted with four bands of colouring that are approximately 10" wide and are colour white on the first (inside) lane, black in the second lane, gray in the third lane and white in the fourth (outside) lane. These are known as Lane 1, Lane 2, Lane 3 and Lane 4 respectively.
- There is a physical divider approximately  $\frac{3}{4}$ " wide, 4" to 6" in height and 8' long down the middle of the track which the Chariots are required to completely encircle as they race around the track in a counter-clock-wise direction.
- There is a similar barrier on the outside of the track which they are not to cross over.
- There are two 180° ( $\pi$  radians) turns in the track: Turn 1 is the first turn they have to negotiate, Turn 2 is the second.
- The starting line just after Turn 2 and is staggered in such a way that the distance from each lane's start line to where Turn 1 begins in Lane 1 is approximately equal.
- The Finish Line is a straight line across the track at the start of Turn 1.



**Figure 1:** The Circus Maximus Track (not to scale).

## Circus Maximus Tournament Rules

1. The referee's word is final.
2. Teachers are **NOT** allowed to build, program, or any other way do work on the Chariot. Teachers are there to be a guide to the students of the team.
3. Chariots are to act autonomously, i.e., no human control or interference during a match, except as specifically allowed below.
4. At the start of a race, each Chariot must fit into a square 20 cm x 20 cm, with no height limitation. Chariots will be measured before the tournament to ensure they comply with this rule. The referee has the discretion to re-measure a Chariot before any match the Chariot is participating in. Parts of the Chariots may extend outside this area after a match has started.
5. Races start on the command of the referee. Each Chariot must have a 5 second delay after the operator pushes start before their Chariot starts to move. The Chariots will be placed in their assigned lane behind their start line and not overlapping in any way any other lane.
6. A Race is two laps of the track in which the Chariot must travel around the track two complete times plus reach the Finish Line after the second time around.
7. Races will run from the start until one of:
  - a. all Chariots have finished the Race,
  - b. 2 minutes have elapsed, or
  - c. the Referee determines that the no further progression will be possible for any Chariot that has not yet finished the race
8. No Chariot will be eliminated or removed from the track before the end of the race unless it completely crosses the outside barrier by way of its own action or that of its competitors.
9. Chariots MAY be programmed such that pressing either of the arrow buttons on the Mindstorm Brick will reverse the direction of the robot. Only the Referee is permitted to press one of these buttons and will do so only if the Referee determines that the Chariot is moving the wrong way around the track. If this function does not work, no penalty applied and no other adjustments to the Chariot will be carried out.
10. Chariots may not spray any material on the ring or on their opponents, or in any way deform the track. Chariots are not allowed to use any flying components or projectiles.
11. Chariots may use various forms of detection to locate the opponents' Chariots for the purpose of avoiding or attacking those opponents. They may also incorporate stealth technology to avoid detection by the opponents' Chariots. Signals may be used to try to confuse the opponents' Chariots' detectors.
12. The Bluetooth functionality of the NXT brick must not be used.
13. The Chariots may be programmed using languages or IDEs other than the Mindstorm NXT software.
14. No additional parts other than those in one standard Lego Mindstorms NXT kit are allowed. The exception to this rule is that a team may use additional standard NXT sensors (e.g., light sensor, bump sensor, etc.) beyond the number included in the standard kit. Furthermore, minor digressions from that rule that do not affect the performance in a significant may be allowed at the Referee's discretion.

## **Chariot Tournament Structure**

The Tournament will be conducted in two stages: the preliminary rounds and the playoff rounds. During the preliminary rounds, each team will play the same number of races.

For each race, points will be awarded as follows for the Chariots that cross the Finish Line in order or who have progressed furthest towards the Finish Line at the end of the race:

|                        |           |
|------------------------|-----------|
| First (first to cross) | 10 points |
| Second                 | 6 points  |
| Third                  | 4 points  |
| Fourth                 | 2 points  |

The teams that place as above but have not crossed the Finish Line at the end of the race will be deducted 2 points.

In addition to the above points, two bonus points for each opposing Chariot that a Chariot eliminates or disables during a race will be awarded. The awarding of these points is at the discretion of the referee. The purpose of these bonus points is to encourage teams to actively seek-out and engage other Chariots in the course of the race.

In the event that there is a tie, normal match rules will apply. For example, two Chariots tied for first place will both receive first place points, the next Chariot will receive third place points.

The top 16 teams based on total number of points from the preliminary races of the tournament will advance to the playoff rounds. In the event of a tie for the final position in the playoffs a single race between the tied teams will determine who advances.

The playoffs will use the same scoring system as above for each of a quarter-final, semi-final and final round. Depending on time, each round will consist of one to four races depending on available time. The top two teams from each quarter-final and semi-final group will advance to the next round. The number of races will be announced before the start of playoffs.

In the event of a tie during the playoff rounds, a one-off race between the tied teams will take place to break the tie to determine who moves on.

## **Prizes**

Prizes will be awarded for the top eight finishers. In addition there will be an award for the best engineered Chariot. Judgment for the best engineered robot will be based on the robot design/performance in addition to the technical report.

**GOOD LUCK!!!**