Engineering Design Challenge I

Who Leads on Water?

Scoring Description

One. Game scores

GAME 1 – KING OF SPEED

For the speed game, the boat is given points based on the following formula (time in seconds):

$$\text{Speed game points} = 110 - \frac{\text{Best team time} - \text{Best overall time}}{\text{Best overall time}} \cdot 80$$

- Only the best time is considered for the game scoring.
- If a boat leaves the game area, or violates the "no-interaction rule", the team loses the round with 0 points.
- If the time for the boat exceeds 90 seconds, the round is stopped, and a time of 90 seconds is used to score that round.
- If parts fall off the boat, the score for the round is penalized by subtracting 20 points.
- The timing starts the moment the flag is lifted from in front of the boat, and stops at the moment any part of the boat crosses the finish line.

GAME 2 – OBSTACLE COURSE

The boat is given "action points" based on the number of crossings it makes, and based on the number of 360° turns, as follows:

$$\text{Action points} = 9 \cdot \text{\# of crossings} + 6 \cdot \text{\# of } 360° + 5 \cdot \text{\# of } 720°$$

- There is a total of 7 crossings and 2 roundabouts in the game.
- A boat can only get points for any given crossing once, and for any given 360° turn twice (once as a 360° turn and the other as a 720° turn).
- The crossing is counted only if the boat completely passes through the imaginary crossing line.
- A 360° is scored if the boat completes the two crossings completely and repeats the one it started with (check figure 1 below). A 720° is scored after a second 360° turn.
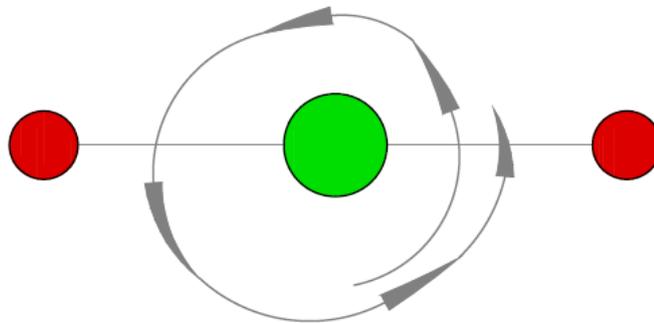

Figure 1: 360 degree turn

- A score multiplier is determined as follows:

$$\text{multiplier} = 0.05 \cdot \text{\# of carried cargo} - 0.10 \cdot \text{\# of lost cargo}$$

- The points for the game are then determined:

$$\text{Obstacle game points} = \text{Action points} \cdot (1 + \text{multiplier})$$

- If parts other than the cargo fall off the boat, the score is penalized by subtracting 20 points.
- The timing starts as soon as the boat starts moving, or 15 seconds after the boat is placed, whichever happens before.
- The game goes on for 2 minutes.
- If a boat leaves the game area, the game stops immediately and the score is determined as if the time had run out.

GAME 3 – WATER TANKER

The boat gets a score based on the amount of water in the target tank when the game ends, according to the following formula:

$$\text{Water game points} = 0.1 \cdot \text{volume in ml}$$

- Water that fills the target tank should come from the source tank, and be moved with the cup provided. Any boat that fills water from the pool is immediately disqualified with a score of 0.
- The boat may not block the top of the cup, as outlined in the game rules.
- The boat has to move through the complete track; crossing the middle divider is not allowed.
- If a boat leaves the game area, or crosses the middle curtain, the scoring is immediately stopped.
- The timing starts as soon as the boat starts moving, or 15 seconds after the boat is placed, whichever happens before.
- The game goes on for 2 minutes 30 seconds, after which the water in the target container is measured for scoring. If the game finishes with the boat fully in the unloading area, the team may unload whatever water the cup is carrying before the water is measured.
- If the cup falls off the boat, the game stops, and a penalty of 10 points is subtracted from the game score.
- If parts other than the cup fall off the boat, a penalty of 20 points is subtracted when scoring.

TOTAL SCORE

For the total score, the scores from the 3 games are combined for field points.

$$\text{Field points} = \text{Speed game points} + \text{Obstacle game points} + \text{Water game points}$$

The minimum score for any game is 0; no team will get negative points from any game.

While there is no enforced maximum on the score for any single game, the field points score will be capped at a maximum of 300 points.

This score is then normalized out of 60% for the judging as follows:

$$\text{Total score} = \frac{60\%}{\text{Best points}} \cdot \text{Field points}$$