Mechatronics Lab Autonomous Sumo Competition – Instructions & Requirements

1. Objective

Build an **autonomous robot** on the **Arduino Alvik platform** that:

- Navigates a **2-meter diameter arena.**
- Competes against **4–6 other robots.**
- Uses onboard sensors and actuators to **capture and hold the central hill** (marked red/blue) or remain as the last operational robot within the arena.

Competition Duration: **10 minutes**

2. Technical Requirements

a. **Autonomy**
   - No manual control during matches.
   - The robot must start, navigate, and decide actions autonomously.

b. Sensors - You must collect and log data from at least:
   - Encoders (for odometry).
   - IMU (orientation).
   - Distance or line sensors (for arena edges).

c. **Data Logging -** During each match, log:
   - Time-stamped sensor data.
   - Actuator commands.
   - State transitions (e.g., searching, attacking, defending).
   - Use wireless logging (using Wi-Fi scripts from Lab 5) to keep the robot untethered.

d. **Arena**
   - Arena floor: 2 meters diameter.
   - Border: marked by black tape or 3D printed tilted surfaces to detect edges.
   - Center hill: small raised area painted red/blue.

3. Scoring

- **Primary goal:** Be on the hill at the match end.
- **Secondary goal:** Be the last robot operating inside the arena.
- **Bonus Points:**
    i. High-quality plots and analysis of your sensor data.
    ii. Trajectory reconstruction using **wheel odometry and a 2-DOF differential drive kinematic model**

4. Report Deliverables

Each team must submit a **concise technical report** containing:

a. **Block Diagram**
    - Show the software architecture and sensor/actuator connections.
b. **Code Overview**
    - **1–2 pages** of commented code snippets demonstrating:
        i. Autonomous state machine logic.
        ii. Sensor data acquisition.
        iii. Actuator control.
c. **Tactics Explanation**
    - **½ page** describing your robot's strategy:
        i. How you search for opponents.
        ii. How you avoid falling out.
        iii. How you attempt to capture the hill.
d. **Data Plots**
    - Time plots of:
        i. Encoder counts / Wheel position.
        ii. IMU angles.
        iii. Distance sensor readings.
    - **Bonus points**, include a **2D plot of the estimated trajectory** from odometry.
e. **Concluding Experience**
    - **½ page reflection** discussing:
        i. Challenges encountered.
        ii. Insights gained.
        iii. What you would improve.