National Society of Black Engineers
Pre-College Initiative presents

2008 Team Engineering Design Competition - Middle School

LEGO Mindstorms NXT Sumo Competition

The purpose of the Team Engineering Design Competition is to expose pre-college students to a hands-on, team oriented, collaborative activity that involves mathematics, physics, mechanical engineering, software engineering, computer engineering, electrical engineering, and industrial engineering. Upon completion of the design project, teams will exhibit their designs at the 2008 Fall Regional Conferences. The first place team from each regional competition will receive free registration for the 2009 National Convention to be held in Las Vegas, NV as well as a travel/accommodations stipend to assist with attendance to the Convention. Registration for this competition will close February 28, 2009 at 11:59pm.
NO EXCEPTIONS CAN BE MADE ONCE REGISTRATION IS CLOSED!

Team Engineering Design Team rules

• Each team will consist of only **SIX NSBE Jr. members** and an **ONE Advisor**

• **The following job titles must be filled by each team members**

1 Industrial Engineer
2 Mechanical Engineers
1 Electrical Engineer
1 Computer Software Engineer
1 Computer Hardware Engineer

• Teams are required to meet a minimum of once per week. During this weekly meeting the following is to take place: research, planning, and production of their design. A meeting report form (to be posted on the PCI website) must be completed and submitted with the team documentation.

• Members competing in this competition must be in grades 6-8.

Prior to registration for this competition, job titles must be determined. Once a team has been formed, the team's advisor must register its members on NOL. During the online registration process, each team will have the option to borrow a **LEGO® MINDSTORMS® NXT** kit from NSBE or to purchase their own individual kits from a local or national retailer.

Process to Borrow Kits from NSBE:

Each team is required to acknowledge that they will need a kit during registration.

Each team advisor in need of a kit must e-mail Alaina Law at pci@nsbe.org for a property release form.

Each team advisor is required to fill out this form in its entirety and fax it to 703-683-5312 immediately in order to receive a LEGO Mindstorm kit.

Kits will be mailed to the address indicated during the registration process.

Please note LEGO kits are limited and are distributed on a first come first serve basis. The team advisor holds responsibility for the kits and must return them to NSBE WHQ following the convention.

ALL KITS ARE DUE BACK TO NSBE NO LATER THAN APRIL 6, 2009. IF THE KITS ARE NOT RETURNED TO NSBE ON THE DUE DATE THEN, A $300 FEE WILL BE INCURRED ON THE CHAPTER ACCOUNT.

Robotics Kits Requirements:

Teams who opt to use their own kits can purchase their own **LEGO® MINDSTORMS® NXT** kits or use the old Robotic Invention Systems kits. Teams who chose to use the older kits should understand that the NXT kits make it quicker and easier for robot creators to build and program a working robot in just 30 minutes. Simultaneously, new technologies and expanded sensor capabilities add a level of sophistication to excite and challenge more experienced robot creators. Additionally, the new set is MAC compatible; has an additional input port; is Bluetooth technology enabled; a quick-start program gets you started in 30 minutes vs. 1½ to 2 hrs with RIS2.0; and NXT has a 32 bit processor with more memory. When creating their robots teams must keep in mind the following regulations:

Only components from one kit may be used to create a robot.

No additional parts from other LEGO sets or non-LEGO parts are allowed.

No form of remote control can be used in the missions including a LEGO remote control.

Each robot must be programmed to perform autonomously and can have no human contact or interaction of any kind during the mission.

Each robot must be programmed using the code provided by the kit.

Teams must work towards producing a robot according to the specifications listed below.

All robots will be inspected prior to the actual challenge, any robot found with extra parts from either another LEGO set or non-LEGO set will result in a loss of points prior to the start of the challenge.

The Challenge

To design and construct a robot that is capable of competing against another robot in the following Sumo challenge:

The two competing robots will be placed on the Sumo ring (Fig. 1) about 12 inches apart and 6 inches from the center of the ring. The robots will be placed parallel to each other and facing in opposite directions so that the robots must actively search for the opponent and not "steamroller" straightforward.

The competition will take place in several rounds, each lasting no longer than three minutes. The winner of each round is determined by the robot that has won the best of three bouts, with each bout lasting no more than one minute. The winner of each round receives two points, and the loser receives zero. If, during a bout, the robots are entangled and wear and tear is occurring, both contestants can agree to a restart of that bout. The robots may be restarted but the three minute overall time limit still applies.

At the start of each bout, one member of each team will activate their robots and immediately leave the ring. The robots must wait three seconds before any motion is made, and the first motion should be directly away from the center. If there is no clear front and back to a robot, the direction of this first motion will define the "front" for purposes of the initial facing of the robots. All robots must start moving forward within ten seconds of the start of a bout. The robots will battle until one robot is either disabled or removed from the ring. A robot is considered to be "removed" from the ring when any part of it falls of the edge and touches the floor. A robot whose body hangs over the edge is not considered 'off' until it physically tips off the edge and touches the floor. **Judgment of the ring officials is final.** A robot that disables or removes the enemy gets a "win" credited to it, and if a robot "suicides", then the other robot gets a "win" credited to it.

Vehicle Specifications

1. All robots must fit within a 1’ by 1’ square frame.

2. The LEGO® MINDSTORMS® NXT block must be onboard the robot.

3. Robot weight is not to exceed two (2) pounds.

4. During a match no changes in programming or construction of the robot are allowed

Sumo Ring Specifications

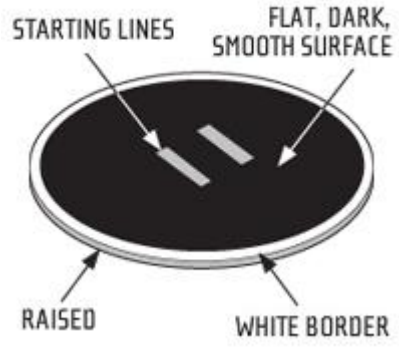

Figure 1

MINDSTORMS NXT Sumo takes place in a circular ring four feet in diameter with a two-inch white border along the ring’s perimeter. The surface of the ring is smooth plywood (painted black) and is about one and one half inches above ground level. The raised platform helps to determine when a robot has “fallen off” (generally determined by the robot touching the ground outside the ring, but left up to the judges’ discretion).

SAFETY:

The objective of the competition is to foster engineering creativity and cooperation. The judges are ultimately responsible for ensuring the safety of participants and spectators during the competition. Contestants utilizing any vehicle or feature deemed dangerous by the judges may be asked at any time to suitably modify the vehicle before continuing in the competition. It is the intent of the competition that vehicles not destroy or damage other vehicles. Offending vehicles may be disqualified at the discretion of the judges. Questions may be directed to the PCI Team until competition day (pci@nsbe.org) or to the judges in person on the day of the competition.

Team Engineering Design Competition Rules

Documentation

A successful design process is often dependent upon its repeatability. If the product cannot be created again without the direct input/supervision of the original design team, then, while the project may be a short-term success, it will be deemed a long-term failure. In order to prevent such failure, the steps involved in the product design and development must be carefully documented. In the completion of this design project, all teams must produce detailed documentation as described below.

1. Each team must complete a meeting report form. This document must be certified by their advisor's signature. Failure to do so will result in a loss of points.

2. Each team member must produce a detailed progress report to be submitted at each meeting. This document must contain the members' learning experience throughout the project. These documents must be certified by their advisor's signature. Any missing reports will result in a loss of points.

3. A sequence of operation for the robot must be produced in the form of a flow chart.

4. A diagram of the robot's construction should be produced from start to finish.

5. Programming code should also be submitted with any necessary comments.

6. A list of reference materials used must be included.

7. All documentation must be in electronic format.

8. Documentation must be no more than 25 pages.

Documentation must be submitted in Microsoft Word (.doc) format. Please use only 12 point, Times New Roman font. All margins should be no larger than 1". PDF documents will be accepted, but will result in a loss of points.

All documentation must be uploaded to NOL by March 11, 2009.

Oral Presentation

The world of science, engineering, and technology is built around technical presentations. Companies rely on technical presentations from technical experts to provide information to a wide variety of audiences. The topics depend on the project and the stage of production in which one participates, while the audiences range from coworkers in a meeting to thousands of participants at a national or international conference.

The goal of a technical presentation is to provide information in a concise, easily understandable format for your audience. Such presentations are augmented by visuals,

but depend prominently upon the oratory skills of the presenters. With your design project, your team must demonstrate the ability to communicate accurately and effectively. The following guidelines must be followed:

1. An oral PowerPoint presentation of no more than 7 minutes must be completed, with an additional 5 minutes for questions from the judges.

2. The presentation should be based on the written documentation produced, describing the engineering design and production in a detailed manner.

3. All group members should be active participants in presenting the material.

4. Presentations should at a minimum include:
    Introduction to the problem
    Design decisions
    Robot functionality
    Learning experience from working with other members of the team

Oral presentations must be submitted in Microsoft PowerPoint (.ppt) only. No other software will be allowed. **All powerpoint presentations must be uploaded to by March 11, 2009.**

Robotics Exhibition

While documentation and presentation are key aspects to engineering, the success of a project is ultimately determined by the ability of the product or process to perform per specifications. Thus, your team's robot will be judged on its ability to perform the mission.

1. Prior to the start of each competition, all registered teams will be assigned an opponent and placed in brackets accordingly. Teams will move forward in the brackets as they continue to win rounds. The team that advances the farthest will be declared the winner of the *Robotics Exhibition* portion of the Engineering Design Competition.

2. All teams must check in with the EDC Coordinator at a designated time prior to the start of the EDC. During this check in, all robots will be weighed and measured. Any team not complying with the size and weight requirements will have until the start of the competition to redesign their robot.

3. Each team will sign up for a presentation time also during the check in process. Teams must arrive to the presentation area 5 minutes prior to their scheduled presentation time.