

National Society of Black Engineers

Pre-College Initiative presents

2008 Team Engineering Design Competition

with thanks to Binghamton University IEEE chapter

for use of their design competition challenge

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 2009 National Convention to be held in Las Vegas, NV. Registration for this competition will close at 11:59pm on March 15, 2009. **NO EXCEPTIONS CAN BE MADE ONCE REGISTRATION IS CLOSED!**

Team Engineering Design Team rules

- Each team will consist of only **FOUR NSBE Jr. members** and an **ONE Advisor**
- **The following job titles must be filled by each team members**
 - 1 Industrial Engineer
 - 1 Mechanical Engineers
 - 1 Electrical Engineer
 - 1 Computer 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.

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 Mindstorm 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. Teams will only be allowed to use the **LEGO® MINDSTORMS® NXT**. When creating their robots teams must keep in mind the following regulations:

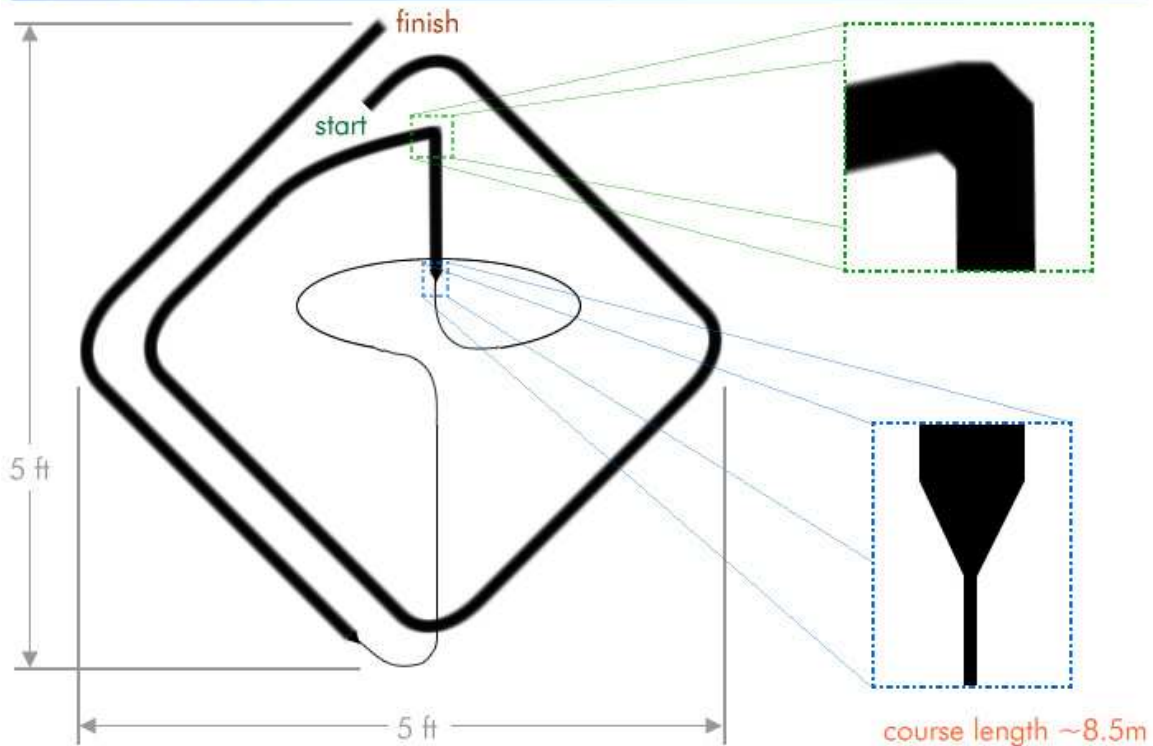
- Only components from one kit may be used to create a robot.
- No additional parts from other LEGO sets or non-LEGO parts are allowed.
- No form of remote control can be used in the missions including a LEGO remote control.
- Each robot must be programmed to perform autonomously and can have no human contact or interaction of any kind during the mission.
- 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

Your robot will need to traverse the course outlined below, which is 8.5 meters in length. While traversing the course your robot will be required to acquire a hackysack along the way and

continue traversing the course with the hackysack within the allotted amount of time. The location, of the hackysack will not be revealed before the competition. There will be times when the track will narrow from a broad line to a thin line, and your robot will need to navigate a sharp corner. The robot will be allowed to run for a maximum of 4 minutes. Each robot will have two chances to travel the course, with the better of the two attempts counted.

IEEE Course



The course consists of a black track, 1.5 inches wide when broad (flat paint) and approx. 1/8 inch wide as a thin line (Sharpie marker), on a white background. The hackysack is 3¼" long and 2¾" wide filled with sands and plastic pellets. For each centimeter your robot travels along the course route, you will receive 0.1 points. Point accumulation will stop once the centerline of the robot deviates more than one inch from the course. (As long as any part of this centerline is less than one inch away, the robot will continue to accumulate points.) You may not touch the robot at any point once it begins traveling the course. The ratio of time your robot spends on the course over the distance traveled will be used as the tiebreaker for the competition in the event of a tie.

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).

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 member must produce a detailed 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.
2. A sequence of operation for the robot must be produced in the form of a flow chart.
3. A diagram of the robot's construction should be produced from start to finish.
4. Programming code should also be submitted with any necessary comments.
5. A list of reference materials used must be included.
6. All documentation must be in electronic format.
7. 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 no later than 11:59pm on 3/15/09.

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 5-7 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:
 - a. Introduction to the problem
 - b. Design decisions
 - c. Robot functionality
 - d. 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 documentation must be uploaded to NOL no later than 11:59pm on 3/15/09.

Robotics Exhibition

1. You will be allowed to use only one robot throughout the entire competition.
2. A maximum of four people will be allowed to compete on any one robot.
3. The length of the robot cannot exceed 7 inches, and the width cannot exceed 6 inches. There is no height restriction. For the purpose of this competition, length is defined as the dimension in the direction of the robot's motion, and width is the dimension perpendicular to the aforementioned direction. Your robot must fit in an open 7" x 6" box.
4. The robot may only use a total of one motor, one light sensor, and one touch sensor. No other sensors may be used, even if they are within the kit provided to the team.
5. At the beginning of the competition, each of the robots will be inspected. Violation of the following rules will result in the penalties described below:
6. Having too many sensors or motors attached at any one time: disqualification from the competition.
7. Using any parts not found in the Mindstorm kit: 5 points deducted per violation, number of violations to be determined by judge based on extent.

8. No modifications may be made to the robot once the competition begins. The only exception to this is that the sensors may be repositioned at any time the robot is not competing in an event. However, all necessary mounts for the sensor must be in place before the competition – in other words, the only things that may move are the sensors themselves.
9. You cannot reprogram your robot at any time during the competition..
10. You are responsible for providing your own batteries. In the event that your batteries die during the competition, you are responsible for having your own set of backup batteries. Do not count on NSBE to have a spare set available.
11. All kits are lent out to groups under the condition that the groups will be responsible for any missing parts. It is your responsibility to make sure that these kits are returned to NSBE in the condition they were issued in.

Notes:

1. Contest rules and specifications subject to change with adequate notice.
2. Field specifications are complete. Construe omission of details as variables in competition.
3. All questions should be directed to pci@nsbe.org, and please allow for 48 hour response time.

Resources

Robotics Links:

<http://www.usfirst.org/>

<http://www.ifirobotics.com/>

<http://www.vexlabs.com/>

<http://www.vexrobotics.com/>

<http://www.chiefdelphi.com/>