

EIGHTEENTH ANNUAL

NORTH JERSEY

ROBOTICS

COMPETITION

**COMPETITION
MANUAL**

Sponsored by
**PASSAIC COUNTY COMMUNITY COLLEGE
ONE COLLEGE BOULEVARD
PATERSON, NJ 07505**

**January 18, 2019
to
May 9, 2019**

18th Annual
North Jersey Robotics Competition
Competition Manual

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1.0 The Competition

The 18th Annual North Jersey Robotics Competition is designed to get students interested, engaged and excited in robotics and requires that a participating school design and build a robot to compete in four different events.

This year the Competition does NOT have an entrance fee. All interested schools should contact the Passaic County Community College STEM Department for more details.

The four events consist of the Modern Marbles Challenge, the Giant Ring Toss Challenge, the Obstacle Course and the Science and Technology Presentation. Each event will consist of three heats (except for the Presentation).

The best score of each team for any event will determine their standing for that event. The team with the best standing over all four events combined will be the Champion of the Competition. In the event of a tie, the tied teams will rerun the obstacle course and the team with the best time will be declared the overall winner.

Teams are REQUIRED to provide different operator(s) for each heat of a given event. This requires each team to have a minimum of nine operators. Some team's robots may be designed to use more than one operator at a time and as such will require additional operators.

Teams are also REQUIRED to provide one paid school employee to act as an Event Official during one of the days of competition. A schedule reflecting when each team should provide their Official will be distributed to the Teams in early May. Teams failing to provide an Official as scheduled will have 100 points deducted from each heat.

1.1 Modern Marbles Challenge

The Modern Marbles Challenge will test the robots ability to play a modernized game of marbles where the robot will roll marbles onto the court to knock other marbles off the inner court.

Once the robot is ready and the Official tells the team to start the robot, the operator will begin to move their robot around the court and position it to release marbles trying to knock other marbles off the inner court. Robots are allowed to start each heat with up to 6 pre-loaded marbles.

As the robot expels its preloaded marbles it can travel around the court but not into or onto the inner court to collect its marbles and continue to try and knock as many marbles off the inner court as possible.

If the robot enters the inner court or any part of the robot touches the marbles while in the inner court the heat will be stopped.

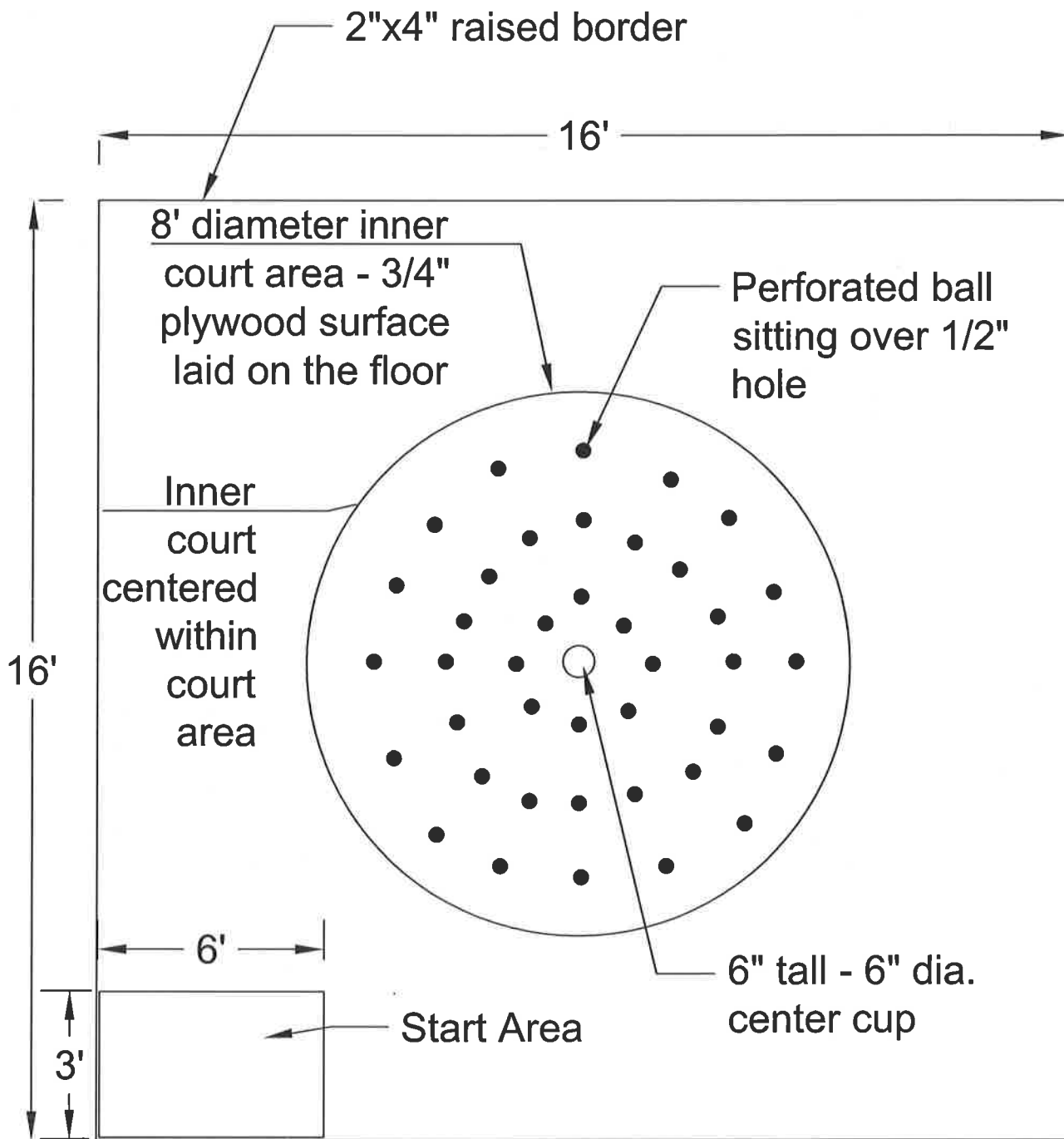
Points will be earned as follows:

- 25 points for each marble knocked out of the inner court
- 300 points for landing a pre-loaded or picked up marble into the center of the inner court

The robot is not allowed to travel outside of the court boundaries. If it does, the robot will be disqualified and the heat will stop. The team will only be awarded the points it has earned prior to disqualification.

Each heat will last for 6 minutes. During the heat team members are not allowed to enter the court and touch their robot. The maximum time allotted to each team, for each heat, shall not exceed 6 minutes from the time the official starts the time clock.

1.1.1 Modern Marbles Court Layout



Operator Station

1.2 Giant Ring Toss Challenge

The Giant Ring Toss Challenge is designed to test a robots ability to move giant disks and place them over the top of various height posts.

Once the robot is ready and the Official tells the team to start the robot, the robot will travel out into the court area and work to pick up the different rings and attempt to place them over any of the four posts they choose.

To receive points the robot must successfully place one or more rings on a post.

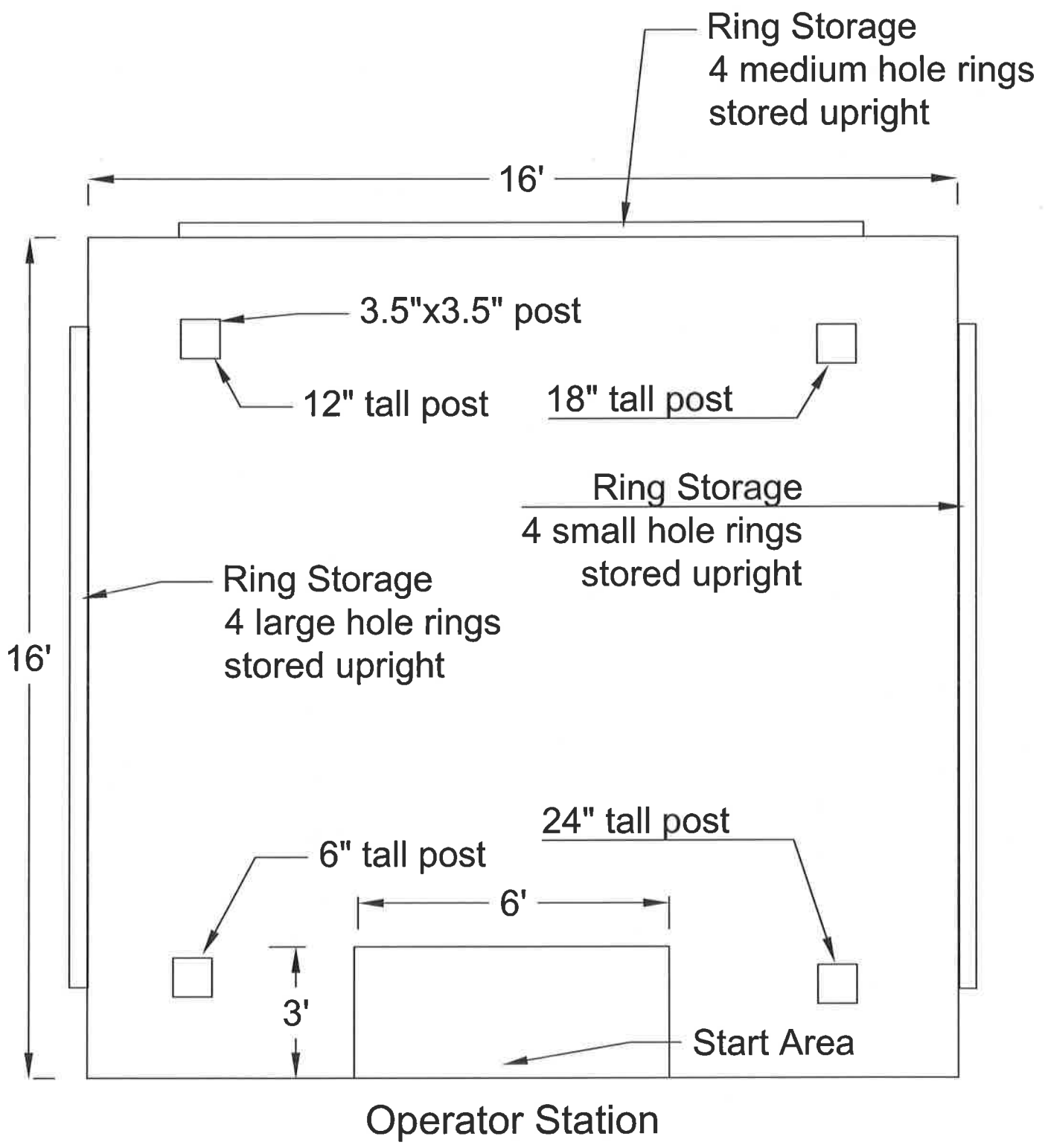
Points will be earned as follows;

- 25 points for large hole ring over 6" tall post
- 30 points for large hole ring over 12" tall post
- 35 points for large hole ring over 18" tall post
- 40 points for large hole ring over 24" tall post
- 45 points for medium hole ring over 6" tall post
- 50 points for medium hole ring over 12" tall post
- 55 points for medium hole ring over 18" tall post
- 60 points for medium hole ring over 24" tall post
- 65 points for small hole ring over 6" tall post
- 70 points for small hole ring over 12" tall post
- 75 points for small hole ring over 18" tall post
- 85 points for small hole ring over 24" tall post

Each heat will last for 6 minutes. During the heat team members are not allowed to enter the court or touch their robot. The maximum time allotted to each team, for each heat, shall not exceed 6 minutes from the time the official starts the time clock. Teams unable to perform within the first 3 minutes of the allotted 6 minutes will not receive any points for that heat.

If a ring falls outside the court while it is being picked up the Officials can replace it once the robot works to pick up a different ring.

1.2.1 Giant Ring Toss Court Layout



1.2.2 Giant Ring Toss Details



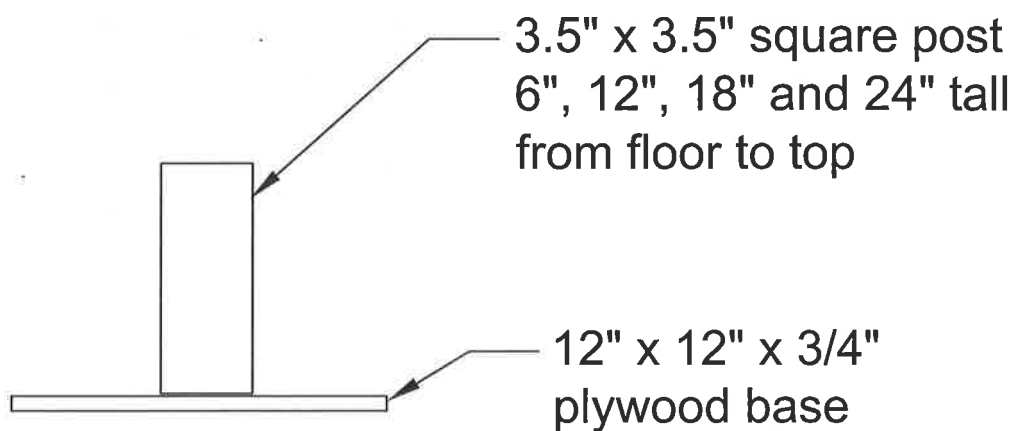
Small hole ring - 26" dia.
6" hole



Medium hole ring - 26" dia.
10" hole



Large hole ring - 26" dia.
14" hole



3.5" x 3.5" square post
6", 12", 18" and 24" tall
from floor to top

12" x 12" x 3/4"
plywood base

1.3 Obstacle Course

The Obstacle Course competition is designed to test the robot's ability to maneuver quickly through a timed course.

The course will consist of uneven surfaces, sharp turns, hills and various other obstacles. All robots must pass all obstacles to complete the course.

Teams will have three opportunities to travel the obstacle course and the best time will be used to calculate the teams standing.

Teams will be allowed to use a spotter to walk along the side of the course to assist/spot for the operator. The spotter is not allowed to touch the robot. If the spotter touches the robot or the robot touches the spotter the heat will be stopped and the team will earn points only for the portion of the course that was successfully completed.

If a robot travels outside of the course boundaries (two wheels out of bounds at the same time) the heat will be stopped and the team will earn points only for the portion of the course that was successfully completed.

Teams are not allowed to test run the obstacle course prior to the competition.

Obstacle Course Point Formula

- 25 points for each quarter completed or 100 points for finishing plus
- $1000/(\text{course time in seconds}/60 \text{ seconds})$

1.4 Tie Breaker

If a tie exists for first place for the overall Competition Championship the teams involved in the tie will rerun the obstacle course.

Each team involved in the tie will have one opportunity to run the course and the team with the fastest time and/or furthest travel will be declared the winner of the tie.

2.0 Rules

1. All participants must behave in a professional and good sportsmanship manner and remember this competition is an educational program for the sole purpose of getting students excited about science, technology and math.
2. The order of play will be randomly determined prior to the start of the competition.
3. Robots built with unauthorized materials will be disqualified until the unauthorized materials are removed. Due to the structure of this year's competition, teams are encouraged to review any questionable materials with the College.
4. Robots that do not meet the Robotic Specifications of this manual will be disqualified until they meet the specifications.
5. Prior to the start of a team's first heat a disqualified robot may be modified to qualify and meet specifications.
6. Robots may not be modified after inspection.
7. Broken parts may be repaired with new identical replacement parts.
8. Teams will be given 3 minutes to set up for an event. If a team is not ready to compete within the 3 minute time period they will not receive any points for that heat.
9. Team's highest score for each event will determine their standing for that event. The best overall standing for all four events combined will determine the Competition Champion.
10. Any controversies derived from the rules or actual competition will be resolved by the Competition Judge. The Judge's decision is final.
11. Robot malfunctions or operator error will not be grounds for additional heats.
12. Robots will be disqualified from a heat if it contaminates or damages the playing field or is designed to intentionally cause damage to any other robot.
13. Teams are not allowed to practice on any of the events prior to their scheduled heat.
14. Robots must maintain their design as inspected for all four events.
15. Each team will be granted two 2 minute emergency repair time outs that can only be used prior to the start or failure to start of a heat. Once a robot starts to move, a time out cannot be called. Each team can only have two student members enter the court to attempt the emergency repair. Team Advisors are not allowed on the court to facilitate repairs.

2.1 Pit Rules

1. Only paid school personnel and students whose names have been provided to the College prior to the Roster Deadline are permitted in the pit area. Advisors are asked to manage their own teams responsibly.

2. No materials or spare parts will be permitted in the pit area. The College will provide a storage area for those items a team brings outside of the pit area. Teams will only be allowed to access a replacement part once they have demonstrated that an existing part is damaged, malfunctioning or broken.

3. Team Advisors are not permitted to work on the robots. They should offer advice and guidance to the students as this is a student centered learning experience.

3.0 Scoring

Teams will have three opportunities, heats, to get the best score possible for any given physical challenge event.

Whenever possible, all teams will have competed in the first heat of a given event prior to any team starting their second heat. All teams will have competed in the second heat of a given event prior to any team starting their third heat.

Any team that is satisfied with their first or second heat score may voluntarily take a bye (sit out) from their second or third heat for non-head to head events only. Teams which robot is not functioning may take a bye in the first heat. Therefore, all robots must be ready to compete when called to do so.

Example:

<u>Team</u>	<u>Event</u>	<u>Heat</u>	<u>Points</u>		
Team "A"	Marbles	1	100		
	Marbles	2	300		
	Marbles	3	100		
				Highest Points	300
	Ring Toss	1	500		
	Ring Toss	2	100		
	Ring Toss	3	300		
				Highest Points	500
	Obstacle	1	310		
	Obstacle	2	280		
	Obstacle	3	50		
				Highest Points	310

Note: Calculation for the Obstacle Course will be rounded up from 0.5 and higher

4.0 Robotic Specifications

1. The robot must be built using the parts provided in the specified Tetrrix kits as well as items from the Additional Hardware List only.
2. Read the entire manual and check all parts prior to starting the robot design.
3. The robot, in its natural resting position, must meet the following dimension requirements.
 - Width = Greater than 17 inches but less than 22 inches
 - Length = Greater than 17 inches but less than 25 inches
 - Height = Greater than 19 inches but less than 32 inches
4. Robots must start each heat in their natural resting position/size.
5. Robot weight is not limited.
6. All robotic control equipment information can be found in the Tetrrix and NXT Mindstorms Robotic Kit manuals and at tetrrixrobotics.com and mindstorms.lego.com.
7. All robots must be completely self-contained; all functions must be controlled by the controller and power provided by the battery pack supplied in the kit. Only the batteries used to provide the current power source should be on the robot. No batteries should be used for ballast. Batteries can not be combined to increase voltage or current.
8. The connectors provided in the kit must be used if connections are not soldered.
9. Each robot must display their team's school name in 3-inch high letters on a clearly visible part of the robot. Signage is exempt from Additional Hardware list restrictions.
10. All items from the parts kit may be used as supplied or modified as needed by your design.
11. All items from the Additional Hardware List must be used as specified.
12. It is recommended that controller relay outputs not power more than one device per output.
13. Only electrical tape may be used on the robot for the specific purpose of acting as an electrical insulator. No tape may be used for structural robot construction or wire management.
14. Any fabricated part, modified kit part or modified Additional Hardware Item must be fabricated by team members on school property using equipment that is generally available to the student body. No outside vendor or professionally fabricated parts are allowed.

15. All electrical connections must be secure. All wire connections must be either soldered together or crimped to a solderless connector prior to termination.
16. Due to the structure of this year's competition, teams are strongly encouraged to review any questionable materials with the College so as not to face last minute disqualification problems.
17. Teams wanting to operate their robot by using two separate remote control operator stations may do so provided that one operator control both stations or that a second operator be used. If a second operator is used, more operators will be needed to satisfy the operator and student participation requirements of the competition.
18. Teams may use either version of the Mindstorms controller, NXT or EV3

4.1 Remote Control Operations

This competition will require each team to operate their robot via Bluetooth wireless technology through the Tetrrix and NXT/EV3 Mindstorms components and software. Teams must report the name of their connection to the College so no two teams will have the same communication connection names. To avoid interference from other teams do not release the name of your connection to anyone other than the College.

4.2 Progress Reports

Teams must submit periodic progress reports approximately every 20 days by email to the College. Each progress report must include a 200 to 300 word narrative regarding progress, significant activities and design ideas/concerns along with five photos (right side/left side/front/back/top) of the actual robot. Teams must demonstrate progress and not just send pictures of parts. Lack of a proper written narrative or demonstrated progress is considered the same as failing to submit the report. Reminder, PCCC and your school are institutions of education and the reports should demonstrate this.

Reports must be submitted to both of the following addresses. Drop Box file sharing accounts may also be utilized.

tvanaken@pccc.edu

dhernandez@pccc.edu

Teams that fail to submit complete progress reports as outlined by the date and time indicated in this manual will be penalized 100 points in each heat for each progress report not submitted on time.

Teams are encouraged to submit the report **1 or 2 days** ahead of time and follow that up with a second email asking for confirmation. Reports should not be submitted a week in advance as they should be as up to date as possible.

4.3 Team Review

Team Review is a **mandatory component of the competition**. Any team that plans to compete in the competition must participate.

Team Review will consist of one member of each team joining together to form a construction review team that will inspect all participating robots. The review team will be supervised by the College. Team advisors do not participate in the review. Additionally, no other team members will be allowed into the inspection area during this review. Teams must participate in this review process.

Each robot will be inspected to insure that it conforms to the rules and specifications described in this manual. Each robot inspection will be approximately fifteen minutes long. Questions, regarding the materials or construction, must be answered by the inspection team member that represents the team that built the robot.

All members will be asked to sign off on each robots compliance or deficiencies. Once all robots are inspected the College will attempt to notify any team advisor that is not present of any deficiencies that need to be corrected.

Corrective actions can be completed (with the presence of a team advisor) that evening until 8:30pm and between 7:00am and 9:00am on the first day of the competition. Once corrective actions have been completed, the team must notify the College and the College will then inspect to verify the corrections and certify that the robot can compete.

Robots that are not certified can participate in events but their score will not be included as part of the competition. These teams will also not be able to participate in the Science & Technology Presentation.

In the event that a team/robot is late for Team Review, the team will be penalized 20 points per 30 minutes after the 4:00pm deadline. These points will be deducted from every heat during the competition. A team/robot that arrives after Team Review has concluded will not be allowed to compete for points.

5.0 Robotic Kit

The following list identifies the basic Tetrrix and NXT Mindstorms kits and components that will be needed to construct a robot and compete. It is our intention that teams will either already own, are eligible for financial assistance from the Passaic County Community College STEM Program/Grant or will be purchasing these items from the supplier.

While the list below identifies the basic parts, teams are allowed to use unlimited Tetrrix and NXT Mindstorms parts (excluding motors) to construct their robot. The EV3 controller is also allowed to be used.

Each team is only allowed to use a maximum of ten (10) motors in their robot design. The term motor is inclusive of both drive motors and servo motors and the related components to operate the motor.

Description	Stock #	Quantity
Tetrrix base kit	W41227	1
12v Battery Pack	W39057	1
12v Charger	W39059	1
Expansion kit	W41549	1
Motor connector wires	W31903	2
Motor mount	W39089	2
152 rpm motor	W39530	2
Motor shaft mount	W39079	2
Bluetooth dongle		1
Servo controller	W40959	1
Motor controller	W44354	2
Chain kit	W39174	1
Bevel gears	W38007	2
Game controller		1
LEGO NXT/EV2 Mindstorms base kit		1
DC charger		1
NXT/EV2 rechargeable battery		1
Robot C software		1
LabView software		1

Teams need Robot C or LabView software not necessarily both.

5.1 Suppliers

The following suppliers were used to provide parts for the kit. In the event a team wishes to purchase additional parts they can do so from any source however, it may be easier to use these suppliers directly.

1. Lego Education – Tetrix and NXT/EV3 Mindstorms
www.legoeducation.us

The following suppliers were used to provide parts for the competition courts and tasks. In the event a team wishes to purchase additional items to recreate the tasks at their schools they can do so from any source however, items from these supplier will be the exact items used.

1. Target Stores
 - Golf Balls – Wilson Ultra 500
 - Perforated Practice Balls – Callaway CT27013
 - Sled – Flexible Flyer 0-6866081626-3

5.2 Additional Hardware List

Material on this list can be used in the quantities provided and in the manner described. Schools are encouraged to have items donated if possible. Robots found to contain materials that are not listed will be disqualified. Teams are strongly encouraged to contact the College with any questions regarding using these materials to avoid having to rebuild your robot after Team Review or being disqualified.

Description	Size	Quantity	Use
½" PVC pipe	10'	1	unlimited
½" PVC fittings	½"x ½"	12	connect pvc
¾" PVC pipe	10'	1	unlimited
¾" PVC fittings	¾"x ¾"	12	connect pvc
1" PVC pipe	10'	1	unlimited
1" PVC fittings	1"x1"	12	connect pvc
PVC primer & glue	NA	NA	connect pvc
½" EMT tubing	10'	1	unlimited
½" EMT fittings	½"x ½"	12	connect emt
¾" EMT tubing	10'	1	unlimited
¾" EMT fittings	¾"x ¾"	12	connect emt
½" wooden dowel	8'	1	unlimited
¾" wooden dowel	6'	1	unlimited
¼" plywood	24"x24"	1	unlimited
1/8" Plexiglas/polycarbonate	24"x24"	1	unlimited
¼" Plexiglas/polycarbonate	24"x24"	1	unlimited
¼" dia. Nylon tubing	12'	1	unlimited
Plexiglas/polycarbonate cement	NA	NA	connections
Wireless web camera (not GoPro)	NA	1	viewing
¼" smooth steel rod	6'	1	unlimited
¼" threaded steel rod	3'	1	unlimited
Metal/plastic pipe strapping			
With ½" hole spacing	¾"wide	5'	unlimited
16 gauge or thinner sheet metal			
Galvanized or aluminum	24"x24"	1	unlimited
Aluminum soda can	12oz	4	unlimited
Tin soup can	14-15oz	4	unlimited
Plastic soda bottle	2 liter	2	unlimited
Tetrix/Lego motor/servo	same as kit	4	unlimited
Nuts and bolts	unlimited	unlimited	unlimited
Plastic wire ties – for neatness, wire management and signage only			Not construction

6.0 Safety

During construction, testing and competition please emphasize that safety comes first.

All team members must wear protective eyewear during construction.

Check all electrical wiring prior to connecting the battery and testing the robot.

Provide close supervision and or training for the use of various power tools and equipment used in the construction process.

Test controls in an open area or with the robot propped up such that the wheels or drive mechanisms are not in contact with any surfaces.

Do not chase team members with the robot.

Use caution and proper lifting techniques when transporting your robot.

Robots that do not appear to be stable or suitably constructed will not be allowed to compete.

No students will be allowed in the pit areas or allowed to work on their robot without one team advisors present. Team advisor must be a paid employee of the school district.

During the actual competition, no electrical/electronic equipment, devices or amplifiers will be allowed in the gymnasium or bleachers. Schools/teams wanting to demonstrate school spirit must do so without the assistance of electrical/electronic devices. If you are not sure what you can or cannot use or bring please ask the College for clarification.

7.0 Science & Technology Presentation

During the competition, each team will present their robot to a panel of science and technology professionals. Presentations cannot last longer than 20 minutes. Presentations should explain the how, what and why of their robot. Presentations can include demonstrations and visual aids. Following the presentation, the panel will be allotted ten minutes to ask the team questions. Three to five team members must perform the presentation. One team advisor may attend the session but is not allowed to participate.

Helpful hints for a successful presentation are as follows;

- Presenters should not read from their notes
- Presenters should memorize their information
- Presentations should be made in a professional manner
- Presenters need to project themselves and their voice
- Presenters should refer to their presentation
- Presenters must be able to explain how and why parts were used
- Presenters should be able to explain programming and design functions
- Presenters should control their computer presentation
- Presenters should not complain or comment on the other teams robots or actions

8.0 Awards

The competing teams can earn the following awards.

1. North Jersey Robotic Competition Champion
Team with the best-combined standing
2. Modern Marbles Challenge First Place
Team with the highest points in any one heat
3. Modern Marbles Challenge Second Place
Team with the 2nd highest points in any one heat
4. Modern Marbles Challenge Third Place
Team with the 3rd highest points in any one heat
5. Giant Ring Toss Challenge First Place
Team with the highest points in any one heat
6. Giant Ring Toss Challenge Second Place
Team with the 2nd highest points in any one heat
7. Giant Ring Toss Challenge Third Place
Team with the 3rd highest points in any one heat
8. Obstacle Course Challenge First Place
Team with the highest points in any one heat
9. Obstacle Course Challenge Second Place
Team with the 2nd highest points in any one heat
10. Obstacle Course Challenge Third Place
Team with the 3rd highest points in any one heat
11. Science & Technology Award First Place
Team with the best Science & Technology Presentation
12. Science & Technology Award Second Place
Team with the second best Science & Technology Presentation
13. Science & Technology Award Third Place
Team with the third best Science & Technology Presentation
14. Best of Show Award
Team with the best looking overall appearance and the most complete organized construction as determined by our Science & Technology professionals
15. School Spirit Award
Team that demonstrates the most school spirit as determined by the competing teams' advisors
16. Sportsmanship Award
Team that demonstrates the most cooperative spirit and sportsmanship as determined by the competing teams' advisors

9.0 Time Line

Official Kickoff	January 18, 2019	1:00pm
Progress Report # 1	February 15, 2019	4:30pm
Progress Report # 2	March 15, 2019	4:30pm
Additional Hardware Request Deadline	March 29, 2019	4:30pm
Progress Report # 3	April 12, 2019	4:30pm
Roster Deadline	April 24, 2019	12:00noon
Robots Delivered to the College	May 6, 2019	4:00pm
Team Review	May 6, 2019	4:30pm
Team Review Repairs	May 7, 2019	7:00am
First Day of Competition	May 7, 2019	9:00am
Second Day of Competition	May 9, 2019	9:00am
Awards Ceremony	May 9, 2019	12:00noon
Post Event Meeting	May 30, 2019	2:00pm

10.0 Assistance

For assistance with the project manual, the robot kit or obtaining additional kit parts contact;

Brian Egan
Associate VP for Facilities
Passaic County Community College
973-684-5999
973-766-3717
began@pccc.edu

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