

CougarTech Team 2228		
Competition Handbook		
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Competition Handbook

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REVISION HISTORY

DATE	DESCRIPTION OF CHANGE
V170717	RJV; updated scouting from lessons learned
V161024	RJV; update the use of pivot table
V160825	RJV; updated from lessons learned in 2016
V150608	Original

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide instructions to Team2228 members on responsibilities and process instructions for the Pit, Drivers, and Scouting.

1.2 Scope

This document is to provides instructions to Team2228 members on responsibilities and process instructions for the Pit, Drivers, and Scouting.

1.3 Audience

The audience is for all Team2228 members and mentors.

1.4 References

- NEMO – Judging at regionals

1.5 Definitions

BOM	Bill Of Materials
CCWM	Calculated Contribution to Winning Margin
MSD	Material Safety Data sheets
NEMO	Non-Engineering Mentor Organization
OPR	Offensive Power Rating
PPE	Personnel Protection Equipment

2 OVERVIEW

2.1 Description

At a competition there are four main activates that all Team2228 members and mentors are involved in.

1. Safety
2. Pit Construction
3. Pit Crew
4. Drivers and Human Players
5. Scouting

The robot pit is typically a 10ft x 10ft area where the robot is maintained during a competition. A Pit Construction sub-team is responsible for setting up and taking down the robot Pit. The pit crew is responsible for maintaining the robot during the competition.

The drivers and human players are responsible for working with other team alliances, driving the robot in match competition and interacting with the robot specified by the game manual.

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3 SAFETY INSTRUCTIONS

3.1 PIT Organization

Safety tips for the PIT

1. No Food or Drink
2. All tools must be their proper location
3. No items should hang over shelves
4. First Aid Kit, Exit plan/Mustard location should be visible to all members of the PIT
5. Safety person should lead robot and drive team to matches
6. There should be a notebook for MSD's

4 PIT TEAM - INSTRUCTIONS

4.1 PIT Team Roles and Responsibilities

There is not a lot of room in the PIT. The following team members need to be in the PIT: 1-Mechanical, 1-Electrical, 1-Software, 1-Safety, and one Mentor. The PIT crew is responsible for maintaining and modifying the robot for competition.

Everyone in the PIT needs to understand the Engineering Notebook, Business Plan and Safety notebook to talk to judges.

4.2 Robot Inspection

Before the inspections the PIT crew should go over the Inspection form from FIRST. This should be done before you arrive at an event. You will also need a BOM that includes robot part prices.

There are three inspections:

1. Weight
2. Robot perimeter size
3. Mechanical/Pneumatic/Electrical(you will need a battery to power up the robot)

Team can fail inspection for the following:

1. Battery leads need to be 6 gauge
2. The power switch needs to have easy access and mounted securely
3. There should be pressure gages on the high and low side of the regulator
4. The correct breakers are installed
5. The robot should not have any sharp edges or features that could entangle another robot

5 COMPETITION DRIVER TEAM - INSTRUCTIONS

5.1 Competition Driver Introduction

The driver team is an important part of the competition. A good game strategy and scouting information can win the majority of matches with a weak robot. And a good game strategy with a good robot is unbeatable.

The drive team is not there to have fun driving a robot. The drive team needs to be team members that good character, good leadership skills, are enthusiastic and dedicated to excellence in driving the robot to win matches.

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5.2 Competition Driver Pre-Competition

During robot build the driver team should consider the following:

- 1) Understanding robot abilities
- 2) Which driver is the best (Practice-Practice-Practice)
- 3) Develop a play book should be developed that list strategies for different circumstances and strategies for defense
- 4) All competition drivers should understand what the game fouls are – many times this the key to winning or losing a match.
- 5) Test defense strategies

5.3 Competition Driver Roles and Responsibilities

5.3.1 Driver Coach

The driver coach has the following responsibilities:

- 1) The coach must watch the entire field, keep track of the score and the robots
- 2) The field coach must also watch the referee for warning
- 3) Instructions must always be given. Don't leave driver hanging
- 4) Field coach also must communicate with the alliance partner's field coach
- 5) The field coach should be updating the clock every 10 seconds, with a 10 second countdown at the end
- 6) Game strategies are fluid. The coach should make all decisions to deviate from the initial strategy. The coach needs to calmly reevaluate and come up with a new plan.
- 7) Never lose sight of the main goal – Winning the match
- 8) The coach is also responsible for driver scouting information

5.3.2 Competition Drivers

The competition drivers have the following responsibilities:

- 1) Tune out the crowd and announcer. The drivers must focus on the match
- 2) GIVE IT YOUR ALL, don't be afraid of damage, however, don't take overly dangerous risks
- 3) Drivers should not look up at the clock or score
- 4) Listen to the your coach

5.3.3 Drive Team Practice

At an event you have 20 to 36 minutes of driving time. You cannot learn how to drive and perform all the operations then. Practice before an event is extremely important in winning matches. Coaches and drivers need to be driving as soon as possible in the robot build season to understand the capabilities of the robot and develop driving strategies. CYCLE TIME-CYCLE TIME-CYCLE TIME. Drivers need to practice to reduce the cycle time in performing robot functions to win matches.

5.4 Competition Strategy

At a competition the driver team should consider the following before the match:

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- 1) Team 2228 match strategy is a fine line between being a team player and going it alone. A large part of our team RANK and OPR is based on our individual performance and part of it is based on the Ranking process of the event.
- 2) Work with alliance members on an alliance strategy. **It is best if you can be confident in presenting a strategy at your pre-match alliance meeting and then negotiate an alliance strategy.**
- 3) In a good alliance strategy each robot's actions are defined.
- 4) It would be helpful if you had PIT data of other teams before each match.
- 5) Never mislead your partner about your abilities. If you can't do something, make sure they know that. Winning the match is the first priority.
- 6) Each plan should include contingencies. Create time limits on actions. If something is taking too long, you have to move onto the next. Many teams lose matches because they don't abandon failed objectives fast enough.

After a match the team should review what went well and what. From scouting information you may have to readjust your strategy. You need to adapt to the competition.

For finals meet with your alliance and discuss strategy. Each robot may have more targeted strategy. Also, a good strategy is key to beating a technically superior alliance.

5.5 Alliance Interaction

Tips when working with alliance members before a match

1. Introduce yourself – shake hands– you may want to have a business card with the drive team members listed on it.
2. Be confident.
3. Be a leader in the discussion of the alliance strategy – the goal is how to win the match
4. Know your capabilities – don't mislead you alliance members
5. Negotiate your position – it is important that you have the opportunity to score points in the game.
6. Before the event the scouting team should have a list of the top 16 teams from last year. You should have a good relationship with these teams. This will become important when it comes to the semi-finals.

6 COMPETITION INTERACTION: OTHER TEAMS - JUDGES

6.1 Other Competition Team Interaction

6.2 Interacting with Judges

6.2.1 Materials for Judges

1. Business Plan / Chairman's award
 2. Engineering Notebook
 3. Design Process Handbook
 4. Handout about team – who you are and what you have done during the year
-

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6.2.2 *Talking to Judges*

Talking points:

1. Everyone in the pit should be trained on what documents you have.
2. Everyone in the PIT should know the “elevator speech” – talking points. Everyone in the PIT should know where the presentation material and document notebooks are.
3. There should be always someone in the pit to talk to judges.
4. Talk with a LOUD-CONFINEMENT voice.
5. Personnel appearance: No gum, SMILE, be enthusiastic.
6. Answer questions quickly – gives impression that you and your team understand what is going on.
7. Your answer to questions should be short and to the point. This allows the judge to ask more questions and have a better understanding of your team.
8. Remember “A messy PIT is a messy team” – The Pit should be clean at all times.
9. The PIT is not a bus stop – Everyone in the PIT needs to be busy – If you are not busy please leave.
10. The more you speak to judges the more they remember you!
11. The judges watch you during the day – Watch what you say and how you act(no game playing in the stands).

7 *SCOUTING*

7.1 *Scouting Introduction*

Scouting provides projection of opponents strategy in future matches. It is essential for alliance picking and crucial in getting a good second round picking. Scouting also offers a great opportunity to involve more students in the competition.

7.2 *Competition Scouting Roles and Responsibilities*

Scouting Team Leader: The scouting team leader is responsible for organizing the pit and match team member lists. Overseeing data entry into the database and presentation of data for the alliance selection process.

Scouting Members: The scouting members(Students and Mentors) are responsible for accurate data collection and data entry of information.

7.3 *Scouting process*

The scouting is an important part of the competition process in providing robot strategy and data collection on the attributes and performance of other teams. The scouting process has three sections: pre-season (understanding competition team performances from previous years and predicting the outcome of the coming event), competition (data collection in the event) and alliance team selection (data analysis).

7.3.1 *Pre-Season Scouting*

In preparation for the competition season the scouting team should develop the following:

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- 1) From the team's robot strategy develop data collection forms for Pit scouting and Match scouting with attributes.
- 2) Update Team database from previous years with scoring and performance indexes
- 3) Provide analysis of ranking, OPR and elimination results from previous years
- 4) Train team on scouting process before the competition season

7.3.2 Build Season Scouting Data Collection Schedule

7.3.2.1 Week 1

1. Understand game scoring
2. Understand robot functions need to play the game
3. Understand competition team ranking calculation

7.3.2.2 Week2

1. Start to develop PIT scouting data collection questions. (Questions should be designed to be quantitative. All subjective questions should have selective answers.)
2. Data should be collected on the robot construction
3. Data should be collected on the robot functions for autonomous, teleoperation, and end game

7.3.2.3 Week3

1. Start to develop Match scouting data collection questions. (Questions should be designed to be quantitative. All subjective questions should have selective answers.)
2. Data should be collected on scoring actions(objective) – attempts and successes
3. Data should be collected on general performance(subjective) in a quantitative fashion

7.3.2.4 Week4

1. Have a design review of PIT and Match data collection questions. The review should ask the following questions:
 - a. Does everyone understand the questions?
 - b. Do the questions help in evaluating teams?
 - c. Do subjective questions have quantitative selections?

7.3.2.5 Week5

1. Develop data team member schedule and test the operation of the data collection system.
2. Develop Event team ranking based on previous years.

7.3.2.6 Week6

1. Train team on use of data collection process, team member schedule

7.3.3 Pre-Competition Scouting

Assemble a team to watch an event and do a dry run on match scouting. This includes scouts taking data, entering data, and viewing data results.

7.3.4 Competition Scouting Schedule

1. Organize scouting table
-

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2. Start PIT scouting Thurs. afternoon and complete by Fri. morning.
3. Start trial run match data collection on teams that have high rankings/OPR from previous years
4. Thursday night obtain match schedule – make up scout team member team data collection assignments and Team 2228 match list for the drive team.
5. On Friday collect match data.
6. At lunch on Friday collect data and determine ranking/OPR/CCWM. This list is the first selection list (Things can change, but you have to start somewhere). This list tells you two things 1. What teams you need to make a closer association to (what teams to approach and convince you are an asset to their alliance in the finals) or 2. More data on teams you would select for finals.
7. At the end of the day on Friday enter into the database RANK, OPR and CCWM data. Higher OPR number indicate a robot is scoring more points and a high CCWM number indicates a team that is doing a better job at being a defensive team.
8. Friday night, based on data from the pit, match, drive team a selection list is created.
9. On Saturday morning teams on the selection list should be watched again in matches to verify selections made Friday night.

7.4 Scouting Tools

- 1) The norm has been pencil and paper with forms that match this year's game.
- 2) Laptops/tablets for data collection and data analysis
- 3) Smart phones for communications, game information from “The Blue Alliance” or “Spyder”
- 4) The use of a PIVOT table in Excel provides the best tool to organize data for presentation. It allows to ask question of the data quickly during the finals team selection process.

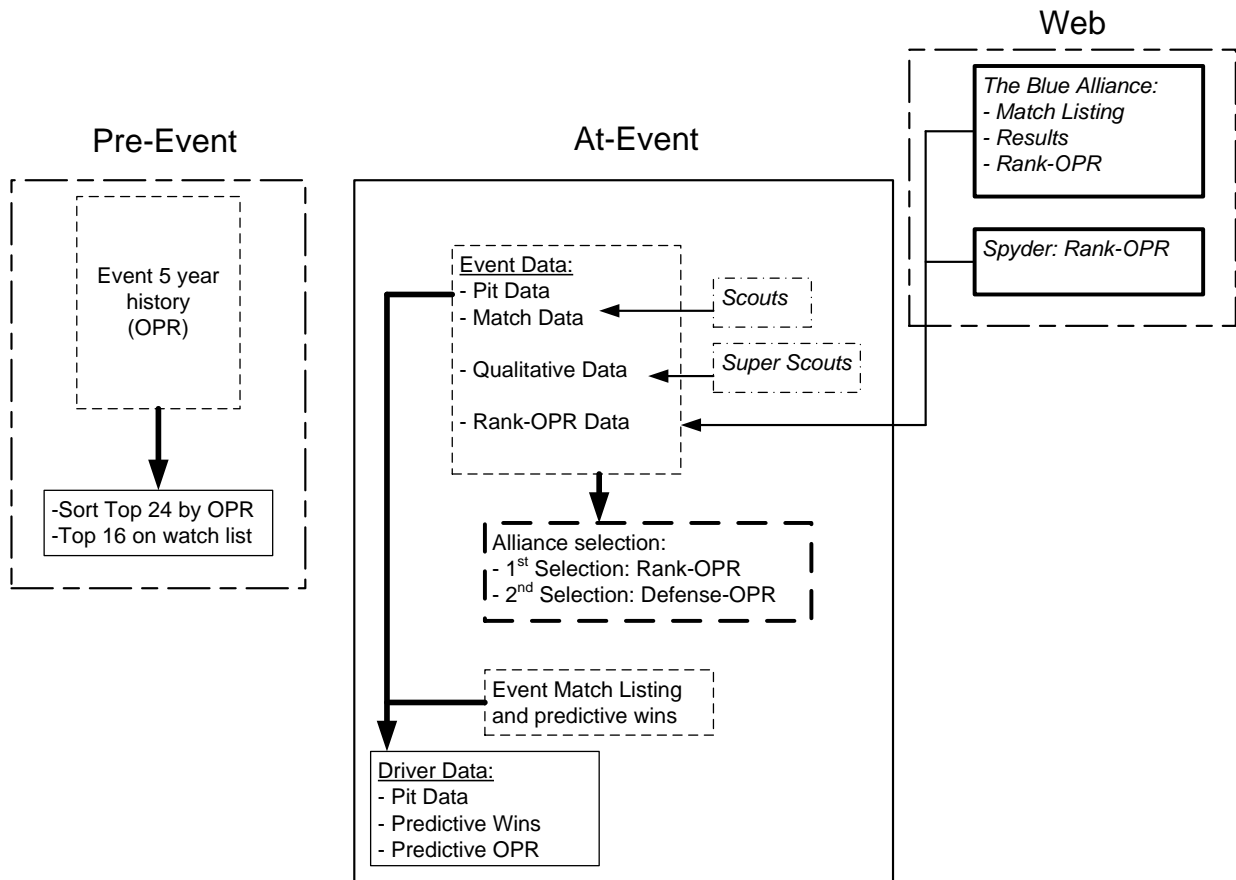
7.5 Scouting Database Organization

The prime keys in the database should be the team number and match number. The database should have data for the following:

1. Presentation of Team Number, RANK, OPR, CCWM, Subjective robot performance(preselected terms)
2. Presentation of Team number, RANK, Team Construction, Game Function capability
3. Presentation of Team Number, RANK, match performance.

7.6 Scouting Data

7.6.1 Scouting Data Flow



7.6.2 Pit Scouting

PIT scouting is about what a robot can do. The pit scouting team needs to obtain the following information:

- 1) Pictures of each robot. There should be three pictures with one of the **pictures with the robot number visible**. The pit scouting team needs to extract pictures and rename picture names with team numbers.
- 2) Type of drive train
- 3) Number of wheels, traction/wheel, drive train gearing(gear ratio), number of motors in drive train.
- 4) Acquisition module method
- 5) Action module method
- 6) Robot Capabilities(key functions needed to play the game): autonomous, teleop, and end game.

7.6.3 PIT Team Scouting

The PIT team will have a list of the top 30 teams from pre-event data. This should be updated during the course of the event. Concentrating on this list the PIT team should document the following:

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- 1) Which teams are constantly fixing their robot?
- 2) Which teams are constantly updating their robot?
- 3) Which teams have developed good mechanisms to perform the functions needed in game?

7.6.4 Drive Team Scouting

The drive team will have a list of the top 30 teams from pre-event data. This should be updated during the course of the event. Concentrating on this list the drive team should document the following:

- 1) Which teams did we worked with the best?
- 2) Which teams were slow in their actions?
- 3) Which teams were in our way?
- 4) Which teams worked with us in having an alliance strategy?

7.6.5 Match Scouting

Match scouting is about how a robot performed. The scouting team leader will organize a team of 6 team members to collect match team data. This team is rotated with different members during the day. The Blue Alliance and FRC Spyder App provides scoring, ranking, and OPR.

The match scouting information should be considered:

- 1) Scoring attempts/failures
- 2) Penalties
- 3) Type of play - offensive/defensive
- 4) Driver/robot subjective performance on match field
 - a. Subjective Performance Attributes: **Active**(did a lot of moving but no results), **Slow**(took a long time to accomplish tasks), **Confused**(appear to not really understand the game), **Successful**(Made points, accomplished tasks quickly, used game time effectively)
 - b. Best team on an alliance: A special scout would watch the whole game and record the best performing robot on the field from the RED and BLUE alliance.
- 5) Attempts at preventing other alliance from getting points

7.7 Alliance Selection

7.7.1 Selection Data

In alliance selection the following information will be used:

- 1) PIT scouting along with robot images
- 2) Blue alliance and FRC spyder data for RANK, OPR, CCMM
- 3) Match performance from match scouting
- 4) Do Not pick list - developed from PIT Crew input.
- 5) Driver feedback - who did they play with the best

7.7.2 Selection Database

The selection database should be an excel spread sheet organized in the following fashion:

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Record Number / Team number / Match number / Rank / OPR / CCWM / PIT Data Fields / MATCH Data Fields

7.7.3 Selection Process

Based just on RANK the alliance selection process starts with the team ranking up to 24 teams (Eight semi-finals teams and 3 robots per alliance). The first 8 teams are the team captains for finals. If we are in the top 12, (The first four highest ranking teams could select one of the remain four highest ranking teams to be an alliance member.) We need to have a list for first choice and second choice team alliance. Remember that the second pick can be crucial to the success of your alliance.

7.7.3.1 Selection Process Step 1

Teams should be listed by Team, RANK, OPR, CCWM, subjective match performance. By the numbers - the first 24 teams in the rankings would be on the top of the list. There is a high probability that the first top 12 teams will be in the semi-finals in the first round of finals team selection by the eight captains. Then concentrate on teams 13-24.

If your rank is less than 9, your selection is from ranking 9-12 – Verify this with other data: drivers, qualitative, play well data, etc.

If your rank is >8, your section is from 13-24 – Verify this with other data

7.7.3.2 Selection Process Step 2

Teams should be listed that complement our alliance to win matches. For example: A lot of defense may not have been seen during prelim matches, whereas, a robot used just for defense in the finals would be beneficial.

7.7.3.3 Selection Process Step 3

Data from the PIT crew and the DRIVE team should eliminate teams that did not perform well, were difficult to work with as an alliance, or had reliability problems.

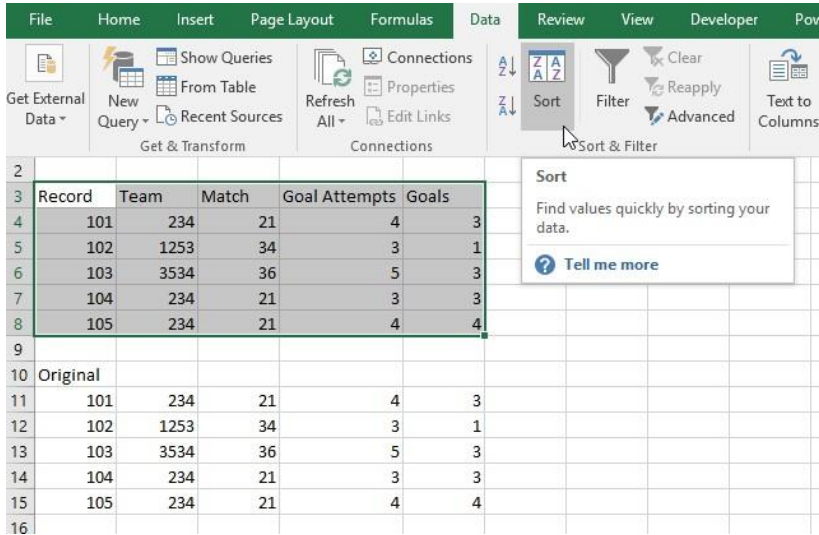
7.7.3.4 Selection Process Step 4

The selection team should be confident in their selection list. The scouting team needs to link the list to matches on Saturday morning to verify the selection team's list for the team captain to use at the semi-finals alliance selection.

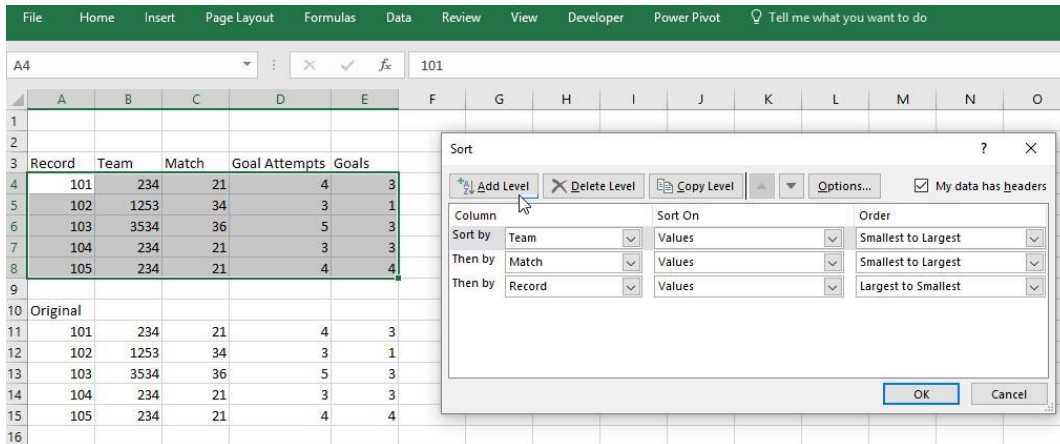
8 Appendix 1: Removal of Duplicate Records

The following Excel method will remove duplicate record entries and save the last entry by a user. This occurs when a user retrieves data, modifies the data and saves the information again.

Select the data array and titles and "Sort" from the "Data" tab



Add three levels of sort. The last level being "Record" and "Largest to smallest" then "OK"



The sort results:

Record	Team	Match	Goal Attempts	Goals
105	234	21	4	4
104	234	21	3	3
101	234	21	4	3
102	1253	34	3	1
103	3534	36	5	3

Record	Team	Match	Goal Attempts	Goals
101	234	21	4	3
102	1253	34	3	1
103	3534	36	5	3
104	234	21	3	3
105	234	21	4	4

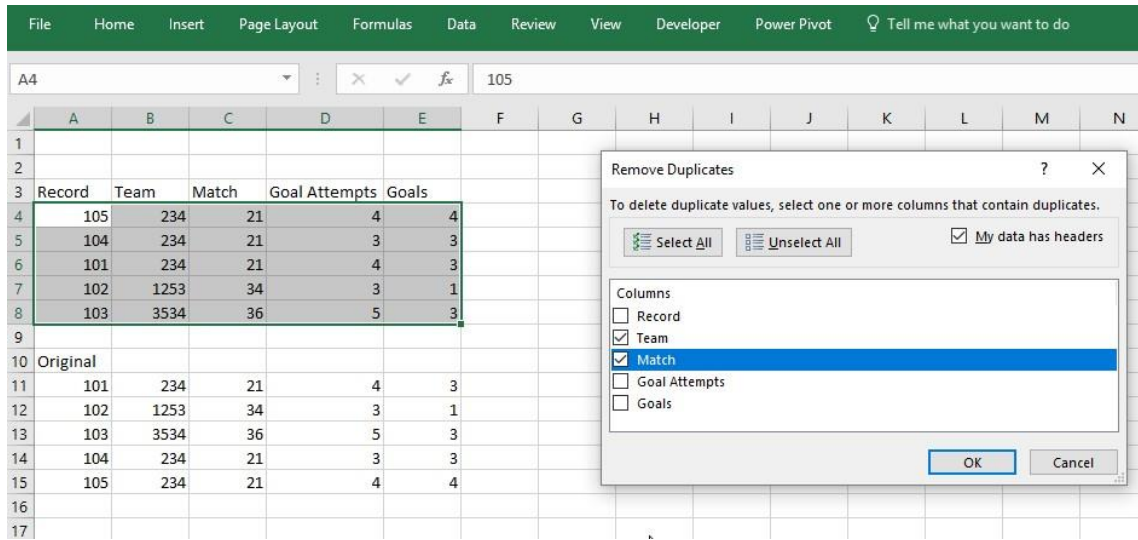
Remove Duplicates and save the highest record; select “Data”, “Remove Duplicates”

Remove Duplicates
Delete duplicate rows from a sheet.
You can pick which columns should be checked for duplicate information.

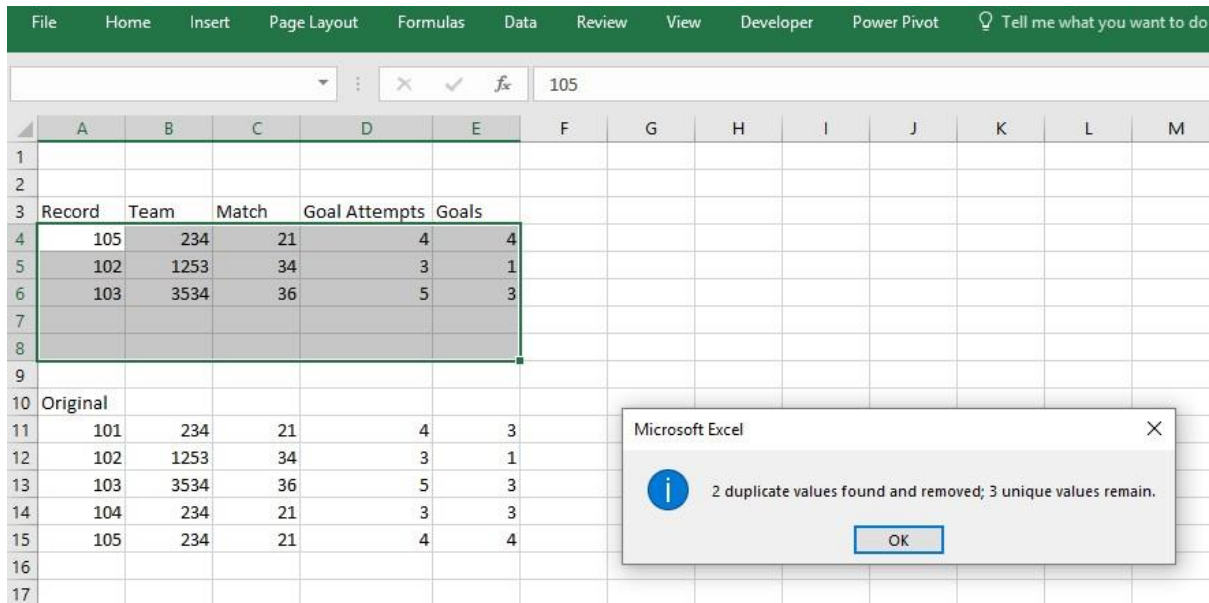
Record	Team	Match	Goal Attempts	Goals
105	234	21	4	4
104	234	21	3	3
101	234	21	4	3
102	1253	34	3	1
103	3534	36	5	3

Record	Team	Match	Goal Attempts	Goals
101	234	21	4	3
102	1253	34	3	1
103	3534	36	5	3
104	234	21	3	3
105	234	21	4	4

Select "Team" and "Match" in popup:



Results:



9 Appendix 2: Build Pivot table

The pivot table organizes data for teams by match. It allows the user to ask questions about teams and compare, sort/rank data.

Example data set:

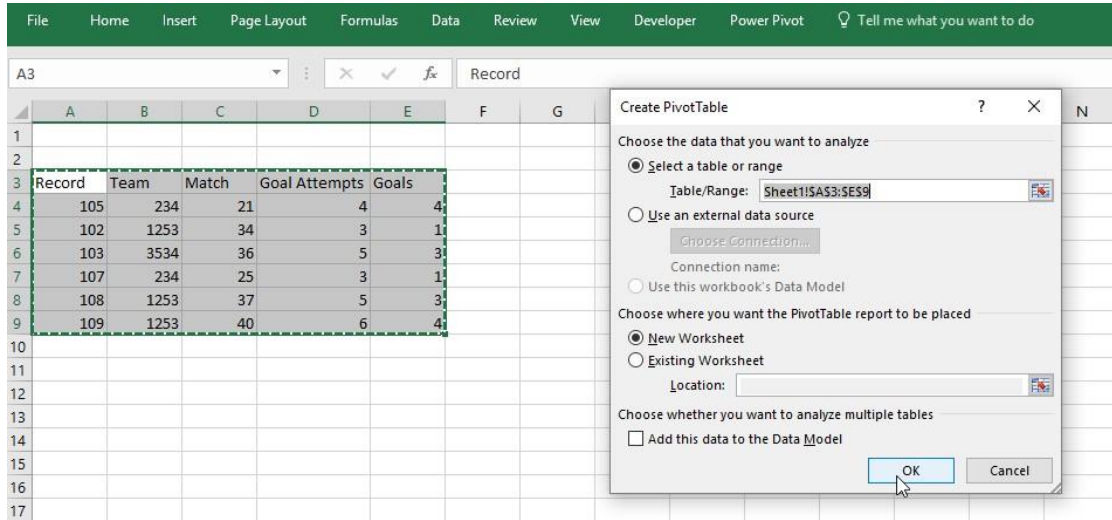
Record	Team	Match	Goal Attempts	Goals
105	234	21	4	4
102	1253	34	3	1
103	3534	36	5	3
107	234	25	3	1
108	1253	37	5	3
109	1253	40	6	4

Select data and titles. Then select “Pivot Table” from “Insert” tab

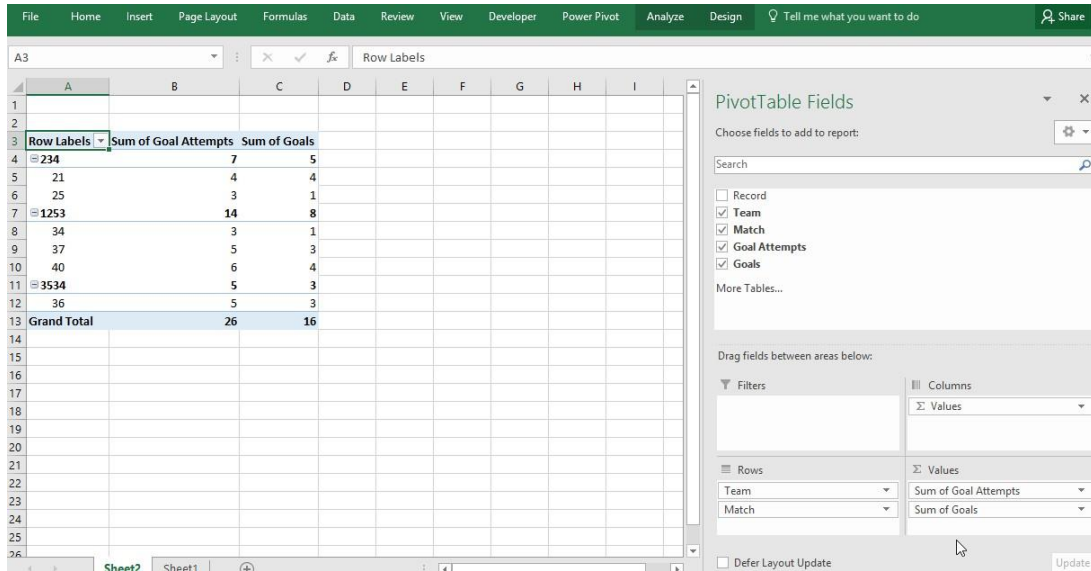
PivotTable
Easily arrange and summarize complex data in a PivotTable.
FYI: You can double-click a value to see which detailed values make up the summarized total.
[Tell me more](#)

Goal Attempts	Goals
4	4
3	1
5	3
3	1
5	3
6	4

Select "OK". This will put pivot table in another sheet of the workbook.

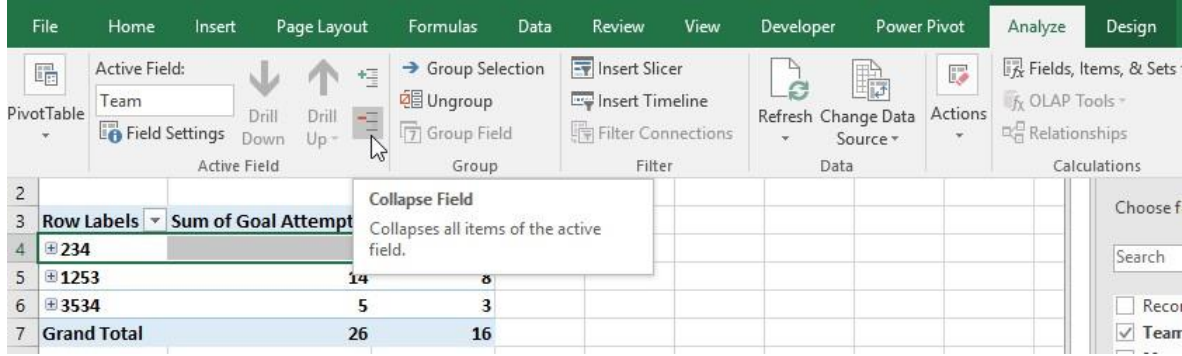


In "Pivot Table Fields", drag "Team" and "Match" to "Rows" box and other fields to "Σ Values"

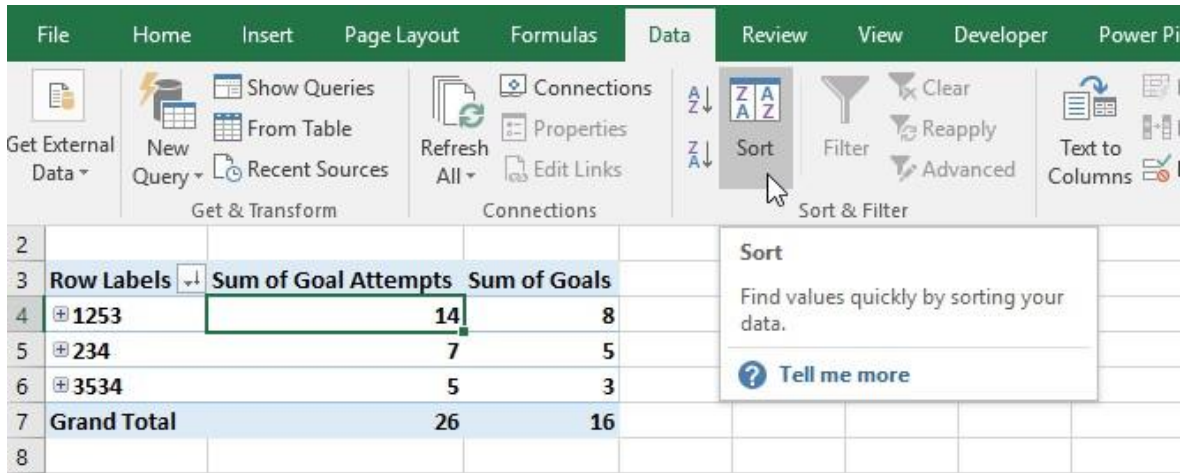


10 Appendix 3: Working With Pivot Tables

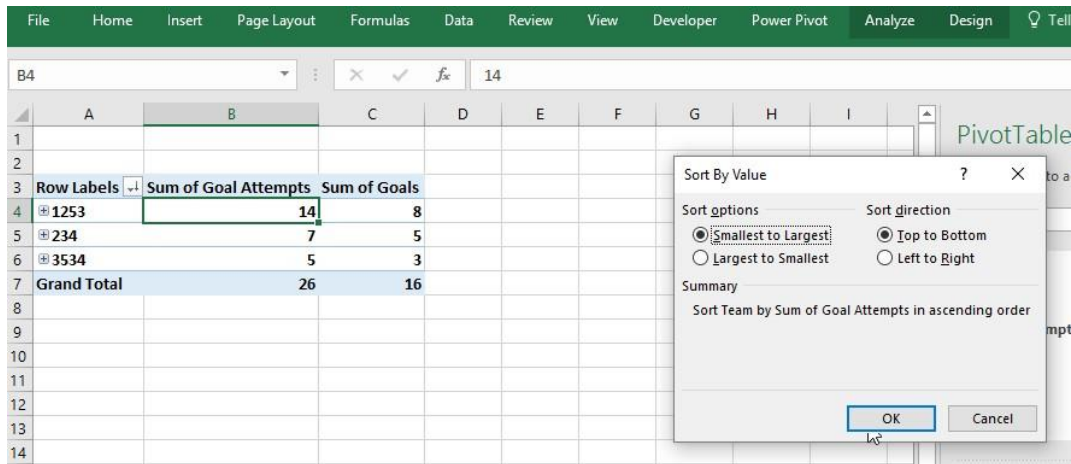
To collapse “Match” and only save result of matches: Select a team, select “Analyze” tab, and then collapse icon.



To sort a column select one data point, select “Data” tab and “Sort” Icon



Select “smallest to largest” or “Largest to smallest” – you can only sort one column



Results:

Row Labels	Sum of Goal Attempts	Sum of Goals
3534	5	3
234	7	5
1253	14	8
Grand Total	26	16

Observing Event trends from a team can be seen in the red box. Team 1253 improves as the event progressed.

Row Labels	Sum of Goal Attempts	Sum of Goals
1253	14	8
34	3	1
37	5	3
40	6	4
234	7	5
3534	5	3
Grand Total	26	16

11 Appendix 3: Excel VBA Code to Display Team Pictures

The following VBA code will display up to six pictures of teams from the team image folder. The spread sheets needs six locations for team numbers and a button to execute the code.

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12 Appendix 4: Mechanical Competition Material Check List

The Tools required at a competition should include the following:

1. Drill press / drill bits
2. Band Saw
3. Hammer
4. Files
5. Pop Rivets / Rivet gun
6. Tape measure
7. Pliers
8. Hot glue gun
9. Screw drivers(Phillips and flathead)
10. Tap handle and taps
11. Wrenches
12. Broom and dust pan
13. Shop vac
14. Hole saw
15. WD-40
16. Loctite Blue Thread locker
17. Allen wrenches
18. Vice

Material required at a competition should include the following:

1. 80-20
 2. 80-20 brackets
 3. 80-20 bolts
 4. 1in x 1in square Aluminum tubing
 5. Nuts
 6. Screws
 7. Woodscrews
 8. Washers
 9. 25 chain half link
 10. 1/4in and 1/16 threaded rod(long bolts)
 11. 1/2in Hex collar
 12. Duct tape
-

13 Appendix 5: Electrical Competition Material Check List

The material required at a competition should include the following:

1. Zipties
 2. Various gauge wire
 3. Batteries(9v, AA, AAA)
 4. Battery Cart
 5. Robot in a box (spares for the control system)
 6. Heat shrink tubing
 7. Battery connector
 8. Soldering iron / solder
 9. Wire crimps and crimping tool
 10. Heat gun
 11. Multi-meter
 12. Electrical cables(PWM, USB)
-

14 Appendix 6: Drive Team Competition Material Check List

The material required at a competition should include the following:

1. Robot traveling cart
 2. Gloves to pick the robot up – these should be USED
 3. Safety glasses
 4. The driver station computer
 5. The driver station joy sticks / automation push button station
-

15 Appendix 7: Scouting Competition Material Check List

The material required at a competition should include the following:

1. 6 Clipboards
 2. Match data collection sheets
 3. Card table
 4. Two chairs
 5. Data entry computer + spar
 6. 50ft electrical cord
 7. Painters tape for power cord
 8. Power Strip
-

16 Appendix 8: Software Competition Material Check List

The material required at a competition should include the following:

1. Program computer
 2. Drive Station computer + spare
 3. Computer chargers
 4. USB cord from computer to RoboRio
 5. Drive Station platform and joy sticks
 6. Power strip
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17 Appendix 9: Safety Material Check List

The material required at a competition should include the following:

1. MSD sheets in a notebook
 2. Well organized safety binder of handouts to show judges
 3. A safety log book to list what went well and what needs improvement
 4. PPE
 5. Fire extinguisher
 6. Hand cleaner
 7. Eye glass cleaner
 8. Ear plugs
 9. Orange cones
 10. First Aid Kit
 11. Battery spill kit
 12. Substitute Safety Captain schedule
 13. Safety Captain vest and hat
 14. Exit plan / Mustard sheets
 15. Garbage bags for team members in the stands
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