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1.0 Introduction

What is FIRST® Tech Challenge?
FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. To learn more about FIRST® Tech Challenge and other FIRST® Programs, visit www.firstinspires.org.

FIRST Core Values
We express the FIRST® philosophies of Gracious Professionalism® and Coopertition® through our Core Values:

- **Discovery**: We explore new skills and ideas.
- **Innovation**: We use creativity and persistence to solve problems.
- **Impact**: We apply what we learn to improve our world.
- **Inclusion**: We respect each other and embrace our differences.
- **Teamwork**: We are stronger when we work together.
- **Fun**: We enjoy and celebrate what we do!

2.0 Gracious Professionalism®

FIRST® uses this term to describe our programs’ intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

Watch Dr. Woodie Flowers explain Gracious Professionalism in this short video.

3.0 How to Use This Document

The Game Manual Part 2 is a resource for all FIRST® Tech Challenge Teams for information specific to the 2019-2020 season’s game.

The intent of this manual is that the text means exactly, and only, what it says. Please avoid interpreting the text based on assumptions about intent, implementation of past rules, or how a situation might be in “real life”. There are no hidden requirements or restrictions. If you have read everything, you know everything.

Key words that have a specific meaning within this document are defined in the Game Definitions section and are indicated with the first letter capitalized, and the entire word in Italics.
4.0 The Game

4.1 Introduction
This document describes SKYSTONE℠ presented by Qualcomm®, the FIRST® Tech Challenge game for the 2019-2020 season. Teams must comply with all rules and requirements stated in this document and in the Game Manual Part 1. Clarifications to the game rules are issued on the Question & Answer section of the forum at ftcforum.usfirst.org. Forum rulings take precedence over information in the game manuals.

4.2 Game Description
Matches are played on a Playing Field initially set up as illustrated in Figure 1.3-1 below. Two Alliances – one “Red” and one “Blue”, composed of two Teams each – compete in each Match. The object of the game is to attain a higher score than the opposing Alliance by locating and delivering Stones and Skystones from the Loading Zone to the Building Zone, building the highest Skyscraper, and placing the Capstone on the Skyscraper. The game is played in two distinct periods: Autonomous and Driver-Controlled.

The Match starts with a 30-second Autonomous Period in which Robots operate using only pre-programmed instructions and sensor inputs. During the Autonomous Period, Alliances earn points by: Repositioning their Foundation in their Building Site; Delivering Stones from the Loading Zone to the Building Zone; Placing Stones on their Foundation; and Navigating their Robots under their segment of the Skybridge.

The two-minute Driver-Controlled Period follows the Autonomous Period. During the Driver-Controlled Period, Alliances earn points by Delivering and Placing Stones from the Loading Zone to the Building Stone. Robots will also build Skyscrapers to go as high as possible without toppling over.

The final 30 seconds of the Driver Controlled Period is called the End Game. In addition to the previously listed Driver-Controlled Period Scoring activities, Alliances earn points by Capping their Skyscrapers with a Team-supplied Capstone, moving their Foundations out of the Building Site, and Parking their Robot in their Building Site.

4.2.1 Game Narrative:
Like the towering structures on the planet of Coruscant in Star Wars, FIRST City is growing and must be resilient and strategic to sustain life and a rising population.

In SKYSTONE℠, your mission is to create a structure that pushes into the skies to represent your alliance.

On your journey, you will work with droid allies to overcome obstacles that stand in your path to building a superstructure of the future and top it off with a crown of achievement—a final capstone to symbolize our reach into the sky, and dreams of a hopeful future.
4.3 Playing Field Illustration
The following illustration identifies the Game Elements and gives a general visual understanding of the game. Teams should refer to andymark.com/FTC for the exact Game Element dimensions. The official Playing Field documents including the official Field Setup Guide are available at https://www.firstinspires.org/resource-library/ftc/game-and-season-info. Please note: Playing Field Wall heights may be different depending on the manufacturer. Wall height measurements are in the official Field Setup Guide. Across the season, Teams may attend events that use Playing Field Walls from different manufacturers, please incorporate that into the design of your Robot.

Figure 1.3-1 – Isometric view of the Playing Field

Figure 1.3-2 – Top view of the Playing Field
4.4 Game Definitions

The following definitions and terms are used in SKYSTONE℠ presented by Qualcomm℠:

Alliance – Each FIRST Tech Challenge Match consists of two, two-Team Alliances. These two Teams compete against an opposing Alliance (also made up of two Teams) to complete the game challenge and to earn the highest score. At tournaments with more than 20 Teams, the semi-final and final round Alliances consist of three Teams each. However, only two of those Teams compete during any one Match.

Alliance Station – The designated “Red” or “Blue” Alliance Area adjacent to the Playing Field where the Drivers and Coach stand during a Match.

Area – The space defined by the vertical projection of the outside edge of a region’s boundary (for example, gaffers tape, goal, Playing Field Wall). The boundary element (tape, wall, markings, etc.) is part of the Area for the purposes of determining Inside and Outside.

Autonomous Period – A thirty-second period in which the Robots operate and react only to sensor inputs and to commands pre-programmed by the Team onto the onboard Robot control system. Human control of the Robot is not permitted during this time.

Block / Blocking – Preventing an opposing Alliance Robot from accessing an Area or Game Element for an extended period by obstructing ALL paths of travel to the object or Area. Active defense played by a Robot shadowing an opposing Alliance Robot that eliminates all paths of travel between the opposing Alliance Robot and an Area or Alliance-specific Game Element or all remaining Alliance-neutral Game Elements is considered Blocking, even though at any frozen point in time there is an open path. See also Trap / Trapping (which may be considered the same except it is from a Game Element or Area of the Playing Field).

Building Site – An Area on the Playing Field marked off in red or blue tape. There is one (1) Red Alliance Building Site and one (1) Blue Alliance Building Site. The taped off area is right triangular shaped with 22.75 inch (57.8 cm) sides.

Building Zone – The Area between the Skybridge and the back (furthest from the audience) Playing Field Wall. For the purpose of Deliver and Return, the Alliance colored tapes and the black Floor Plate define the separation between the Loading and Building Zone but are not part of either Zone.

Capstone – A Team supplied Scoring Element that has passed inspection.

Capping – A Capstone is placed onto a Foundation and the Capstone is fully supported by only the Stones, Foundation or another legally scored Capstone and not in contact with a corresponding Alliance Robot.

Coach – A student Team member or adult mentor designated as the Drive Team advisor during the Match and identified by wearing a “Coach” badge or identifying marker.

Competition Area – The Area where all the Playing Fields, Alliance Stations, scoring tables, on-deck queuing tables, event officials, and other tournament items relating to Match play are located. The Team Pit Area and practice Playing Fields are not part of the Competition Area.

Control / Controlling – An object is Controlled by a Robot if the object is following the movement of the Robot. Objects that are Controlled by a Robot are part of the Robot. See Possess / Possessing to learn about a related term. Examples include, but are not limited to:

- Carrying – holding one or more Game Elements Inside or Outside of a Robot.
- Herding – pushing or impelling one or more Game Elements to a desired location or direction that gains a strategic advantage beyond moving the Robot around the Playing Field.
- Holding – *Trapping* one or more *Scoring Elements* against a *Game Element*, *Playing Field Wall*, or *Robot* to shield or guard them.
- *Launching* – see definition below.

Examples of interaction with *Game Elements* that are not *Controlled* include, but are not limited to:
- *Plowing* – *Inadvertent* contact with *Game Elements* while in the path of the *Robot* moving about the *Playing Field*.
- *Deflecting* – *Inadvertent* contact with a *Launched Game Element* as it bounces off a *Robot*.

**Deliver** – A *Robot* moving an individual *Stone* from the *Loading Zone* to the *Building Zone*. The *Stone* must be *Controlled* by a *Robot*, and the *Robot* must travel from *Completely In the Loading Zone* to *Completely In the Building Zone* for the *Stone* to be considered *Delivered*.

**Depot** – An *Area* on the *Playing Field* marked off in red or blue tape. There is one (1) *Red Alliance Depot* and one (1) *Blue Alliance Depot*. The taped off *Area* is approximately 24 inches (61 cm) x 24 inches (61 cm).

**Disable / Disabled** – A *Robot* that is no longer active for the remainder of the *Match* due to a *Robot* failure or by the request of a referee. *Drive Teams* may not *Disable* a *Robot* without the permission of a Field Technical Advisor or Referee. If a referee *Disables* a *Robot* during a *Match*, they will ask the *Team* to drive their *Robot* to a neutral position on the *Playing Field*, issue a stop command with the *Driver Station*, and place their *Driver Station* in a hands-off location on a tournament-provided structure or the *Alliance Station* floor.

**Disqualified / Disqualification / Disqualify** – A *Team* that is ineligible to compete in a *Match*. A *Team* that is *Disqualified* from a *Match* will not receive credit for the *Match* (that is, no Ranking or TieBreaker points).

**Drive Team** – Up to four representatives two (2) *Drivers*, one (1) *Coach*, and one (1) *Human Player* from the same *Team*. Only one (1) *Human Player* represents an entire *Alliance* in a *Match*.

**Driver** – A pre-college student *Team* member responsible for operating and controlling the *Robot* and identified by wearing a tournament supplied “*Driver*” badge or identifying marker.

**Driver-Controlled Period** – The two-minute time period in which the *Drivers* operate the *Robots*.

**Driver Station** – Hardware and *FIRST* supplied software used by a *Drive Team* to control their *Robot* during a *Match*. A detailed description of *Driver Station* is listed in Game Manual Part 1.

**End Game** – The last thirty seconds of the two-minute *Driver-Controlled Period*.

**End of the Period/Match** - The moment when the *Match* timer reaches 0:00. Also known as *Time Zero* or *T=0.00*.

**Foundation** – A *Scoring Element* for *SKYSTONE℠*. There are two (2) *Alliance* specific *Foundations*, one (1) Red and one (1) Blue. The *Foundations* are approximately 18.5 inches (469.9 mm) wide x 34.5 inches (876.3 mm) long x 2 inches (50.8 mm) tall.

**Game Element** – Any item *Robots* or *Human Players* interact with to play the game. *Game Elements* for this year’s game include: *Stones*, *Foundations*, *Skybridges*, and *Capstones*.

**Human Player** – A student *Team* member that supplies *Stones* and *Capstones* to the *Depot* and is identified by wearing a tournament supplied “*Human Player*” badge or identifying marker. Only one *Human Player* represents the entire *Alliance*. For *Qualification Matches*, an *Alliance* must decide which *Team* will Section 4.0 – The Game
name the Human Player. If the Alliance cannot decide quickly, the Team listed in the match list as "Red 1" or "Blue 1" for the Alliance has the responsibility for naming the Human Player. The Human Player must be from the Teams that are in the Match. For Elimination Matches, the captain of the Alliance has that responsibility.

**Human Player Station** – The Area where the Human Player stands during a Match.

**In (Inside) / Completely In (Completely Inside)** – An object that has crossed into the upwards vertical (i.e., at a right angle to the Playing Field Floor) extension of a defined Area’s boundary is Inside the Area. An object that is entirely within the upwards vertical extension of a defined Area’s boundary is Completely Inside the Area. The boundary element (tape, wall, markings, etc.) is part of the Area for the purposes of determining Inside and Outside, unless otherwise specified. However, the Red and Blue tape under the Alliance Skybridges and the Floor Plate under the neutral Skybridge that separate the Loading Zone from the Building Zone are not part of either zone.

**Inadvertent** – An outcome that is not a planned strategy and not the predictable result of persistent or repeated actions.

**Inconsequential** – An outcome that does not influence Scoring or gameplay.

**Interference** - Interaction between opposing Alliance Robots that amplifies the difficulty of a Scoring activity. Actions that constitute Interference should not be considered illegal except as specified by a Game Rule.

**Interlocked** – The condition where a stud of a Stone or Foundation fits in the recess in a Stone.

**Launching** – Propelling Game Elements with enough force such that they can move independent of contact with the Robot or Human Player.

**Loading Zone** – The Area between the Skybridge and the front (closest to the audience) Playing Field Wall.

**Match** – A head-to-head competition between two Alliances. A Match consists of a thirty-second Autonomous Period followed by a two-minute Driver-Controlled Period for a total time of two minutes and thirty seconds.

**Navigation Target** - Eight (8) unique images mounted on the Playing Field Walls (two (2) images per wall) that Robots can use to navigate around the Playing Field. Images are printed on standard letter size paper, 8 1/2 inches x 11 inches (216 mm x 279 mm) or A4 (210 mm x 297 mm) paper.

The Skybridge has four (4) unique Navigation Targets, two in the Loading Zone and two (2) in the Building Zone. Each image measures approximately 13 inches (33 cm) x 1.875 inches (4.7 cm).

**Off** – Not physically in contact with or Supported by an object, surface, etc. Objects that are Off are also considered Completely Off.

**On / Completely On** – An object that is physically in contact with and at least partially Supported by an object, surface, etc. is considered On. An object that is entirely Supported by another object, surface, etc. is Completely On.

**Out / Outside** – An object that has not crossed into any part of a defined Area is Outside the Area.

**Park / Parked** – The condition where a Robot is motionless.

**Penalty** – The consequence imposed for a rule or procedure violation that is identified by a referee. When a Penalty occurs, points will be awarded to the Alliance that did not incur the Penalty. Penalties are further defined into Minor Penalties (five (5) points) and Major Penalties (twenty (20) points). Penalties may also
escalate to issuing of a Yellow Card or Red Card as a result of a continued occurrence of a rule violation and upon discretion of the Referee.

**Yellow Cards and Red Cards** – In addition to rule violations explicitly listed in section 4.6, Yellow Cards and Red Cards are used in the FIRST Tech Challenge to manage Team and Robot behavior that does not align with the mission of FIRST. Yellow and Red Cards are not limited to just the Competition Area. Teams that display egregious behavior in the pit area, judging rooms, stands, or any other location of the tournament can be issued a yellow or red card for egregious behavior.

Egregious behaviors or behaviors that are repeated (3 or more) times by a Robot or Team member at the tournament can result in a Yellow and/or Red Card. Yellow Cards are additive, meaning that a second Yellow Card is automatically converted to a Red Card. A Team is issued a Red Card for any subsequent incident in which they receive an additional Yellow Card, for example, earning a second Yellow Card during a single Match.

Yellow and Red Cards may also be issued on or off the competition field. For details please make sure to read the Tournament Rules outlined in section 4.2 of the Game Manual Part 1.

**Pin / Pinning** – Preventing the movement in all directions of an opposing Alliance Robot while it is in contact with the Playing Field Wall, one or more Game Elements, or another Robot.

**Playing Field** – The part of the Competition Area that includes the 12 ft. x 12 ft. (3.66 m x 3.66 m) field and all the Game Elements described in the official field documents. From the audience viewpoint, the Red Alliance Station is on the right side of the Playing Field.

**Playing Field Damage** – A physical change to a Game Element or Playing Field that affects gameplay or an action that causes harm to the playability of a Game Element or Playing Field.

**Playing Field Floor** – The top surface of the Tiles that make up the base of the Playing Field.

**Playing Field Perimeter** – The outside face of the Playing Field Wall.

**Playing Field Wall** – An approximate 12 inches (30.5 cm) tall, 12 ft. (3.66 m) long by 12 ft. (3.66 m) wide wall surrounding the Playing Field Floor. The height of the Wall will vary depending on which Playing Field Wall is being used at the event. Robots should be built to interact with all legal Playing Field Walls.

**Possess / Possessing** – An object is in Possession by a Robot if, as the Robot moves or changes orientation (for example, moves forward, turns, backs up, spins in place), the object remains in approximately the same position relative to the Robot. Objects in Possession by a Robot are considered to be Controlled, and they are part of the Robot. See also Control/Controlling.

**Pre-Load** - A Game Element that a Drive Team positions during pre-Match setup so that it is Possessed by a Robot at the start of the Autonomous Period.

**Quarry** – A structure made of four (4) Stones and two (2) Skystones. All six (6) Stones/Skystones are positioned end to end along the floor Tile tab edge, see the Field Setup Guide for the exact location. Prior to the start of the Match the six (6) Stones/Skystones are positioned in one of three (3) randomly selected configurations. See Appendix D.

**Return** – Moving a Stone from Completely In the Building Zone to Completely In the Loading Zone. Stones Returned to the Loading Zone will deduct the points from the Alliance’s Score, regardless of the location of the Robot. Points will not be deducted for Stones accidentally Returned as a result of a falling Skyscraper.
**Robot** – Any mechanism that has passed Robot inspection and a Drive Team places on the Playing Field prior to the start of a Match. A detailed definition of Robot is in the Robot rules section in the Game Manual Part 1.

**Scoring / Score** – Robots earn points for their Alliance by interacting with Scoring Elements and Parking in specific Areas of the Playing Field. Scoring Elements are Scored when they are placed in the appropriate location and are no longer in contact with a Robot from the corresponding Alliance. The Scoring achievements and their point values are described in section 4.5.

**Scoring Elements** – Objects that Robots manipulate to earn points for their Alliance. The Scoring Elements for SKYSTONE℠ are Stones, Foundations, and Capstones.

**Skybridge** – A Field Element that divides the Playing Field. The Skybridge consists of three sections, a Red Alliance section that has 14 inch (355.6 mm) clearance between the pipe and the Playing Field Floor, an Alliance Neutral section with a 20 inch (508 mm) clearance, and a Blue Alliance section that has 14 inch (355.6 mm) clearance.

**Skyscraper** – Stone(s) that satisfy the following criteria:

a) The Stones on the lowest Level in a Skyscraper must be Interlocked with the Foundation. All the remaining Stones of the Skyscraper must be Interlocked with another Stone in the Skyscraper.

b) The Alliance’s Robot must not be in contact with any of the Stones in the entire Skyscraper.

See Appendix E for examples of Skyscrapers.

**Skyscraper Level** – A layer of Stones that is used to form a Skyscraper. Skyscraper Levels must be supported from beneath by either the Foundation, or by being Interlocked with a Stone from the level beneath them (See Appendix E for examples).

**Skystone** – A Scoring Element for SKYSTONE℠. The Skystone is the same size and shape as a Stone, and it has an image on one of the long sides and wrapped onto the top. There are four (4) Alliance neutral Skystones. Each image measures approximately 7 inches (177.8 mm) x 4.75 inches (120.7 mm).

**Stone** – A Scoring Element for SKYSTONE℠. The approximate dimensions are 8 inch (203.2 mm) x 4 inch (101.6 mm) x 5 inch (127 mm) tall. There are fifty-six (56) Alliance neutral Stones.

**Stone Supply** – The supply of Stones that the Human Player uses during a Match.

**Support / Supported / Completely Supported** – An object (i.e. Robot, Scoring Element, Game Element, etc.) is supported by another object if the second object is bearing at least some of the weight of the first object. If the second object is bearing all of the weight of the first object, it is completely supported by the second object.

**Team** – Mentors, supporters, and pre-college-aged students affiliated with an entity registered with FIRST and for the competition.

**Tile** – The approximately 24 inch x 24 inch (609.6 mm x 609.6 mm) foam rubber mat, 36 of which make up the Playing Field Floor.

**Trap / Trapping** – Preventing an opposing Alliance Robot from escaping a constrained Area of the Playing Field or from a Game Element for an extended period of time by obstructing all paths of travel from the object or Area. See also Block / Blocking (which may be considered the same except it is to a Game Element or Area of the Playing Field).
4.5 Gameplay
Prior to the start of the Match, Drive Teams perform some basic Robot setup steps that are described in section 4.5.1. Matches are made up of several periods totaling two minutes and thirty seconds. There is a thirty-second Autonomous Period, followed by a two-minute Driver-Controlled Period. The last thirty seconds of the Driver-Controlled Period is called the End Game. When the Match is over and referees signal, Drive Teams collect their Robots and Capstones, return Game Elements, and exit the Competition Area.

4.5.1 Pre-Match
Field personnel will place twenty-four (24) Stones into each of two (2) Stone Supplies.

Teams have the option to pre-load only one (1) Capstone into their Robot prior to the start of the Match. Teams that elect not to pre-load their Capstone may introduce it into the Depot via their Alliance’s Human Player at any time during the Driver-Controlled Period. Capstones that are not pre-loaded on the Robot must be placed adjacent to the Stone Supply.

Prior to setting up on the Field, the Alliance Partner Teams will decide which Team of their Alliance supplies the Human Player. Only one Human Player for an Alliance may come to the Field from the Queuing Area. Drive Teams with the concurrence of their Alliance Partner, select their Robots’ starting locations with the following constraints:

1) Drive Teams must place their Robots, in any orientation, touching the Playing Field Wall adjacent to their Alliance’s Driver Station.

2) A Robot may not contact another Robot.

3) A Robot may not start in the Depot

When the Robots and Drive Teams are in position, the Human Player must also be in their Human Player Station and stay there for the remainder of the Match.

Once the Referees give the set up complete signal:

1) Drive Teams may no longer touch their Robots until the conclusion of the Match, and

2) Drive Teams may not touch their Driver Stations or Controllers until the Autonomous Period has ended, except to initialize and/or start their Autonomous program using the Driver Station Android device screen. Robots that require Autonomous program initialization to satisfy the Robot starting volume constraint must be initialized before Referees give the set up complete signal.

Prior to the start of the Match, Referees will place six (6) Stones into each of two (2) Quarries with the Skystones located in one of three (3) random configurations.

4.5.2 Autonomous Period
The Match starts with a thirty-second Autonomous Period where Robots are operated via pre-programmed instructions only. Teams are not allowed to control Robot behavior with the Driver Station or any other actions during the Autonomous Period. The Driver Station is placed in a hands-off location during the Autonomous Period so that it is evident that there is no human control of Robots. The only exception is to allow Drive Teams to start their Robot with start commands issued on the Driver Station Android device. Teams must use the built-in thirty-second timer. Following a countdown by field personnel, the Autonomous Period begins. Drive Teams may issue a Robot start command with their Driver Station Android device to run an Autonomous Op Mode. Failure to adhere to this procedure may subject the Team and/or Alliance to a Penalty as specified in the game rules in section 4.6.2.
The **Autonomous Score** is based on completing tasks during the **Period**. Points are awarded for the following achievements:

1) **Repositioning** – A Foundation In the corresponding **Alliance Building Site** at the end of the **Autonomous Period** and not in contact with a corresponding **Alliance Robot** will earn ten (10) points for their **Alliance**.

2) **Stone Delivery** – An **Alliance** will earn points for Delivering Stones from their **Quarry** under their **Alliance’s Skybridge** per the following criteria. Points are awarded based on the order the **Stones** are Delivered independently by each **Alliance**.

   a) Initial two **Stones Delivered** - If these are Skystones, the **Alliance** will earn ten (10) points each. If these are Stones, the **Alliance** will earn two (2) points each.

   b) Remaining **Stones Delivered**: Both Stones and Skystones earn two (2) points each.

   c) Each Stone Returned during the **Autonomous Period** deducts two (2) points, except if the first Stone Returned is a Skystone, which deducts ten (10) points.

   Note: Points are given only when both the **Robot** and the **Stone** it Controls cross completely from the **Loading Zone** to the **Building Zone**. The intent of this rule is to not allow **Robots** using arms to push a **Stone** through, “kickers”, or any other method that does not require the **Robot** to pass completely under the corresponding **Alliance Skybridge**.

3) **Navigating** – Each **Robot** that is Parked over the tape separating the **Loading Zone** from the **Building Zone** and under their **Alliance’s Skybridge** at the end of the **Autonomous Period** will earn five (5) points for their **Alliance**.

4) **Placing** – Each Stone (Stone or Skystone) In the Foundation at the end of the **Autonomous Period** earns four (4) points.

### 4.5.3 Driver-Controlled Period

Directly following the end of the **Autonomous Period**, **Drive Teams** have five (5) seconds plus a "3-2-1-go" countdown to prepare their **Driver Stations** for the start of the Driver-Controlled Period. On the countdown word “go,” the Driver-Controlled Period starts, and Drive Teams press their **Driver Station** start buttons to resume playing the Match.

The **Driver-Controlled Score** is based on completing a series of tasks as outlined below. Points are awarded for the following achievements:

**Stones and Skystones** earn points as follows:

1) **Stone Delivery** – Each Stone (Stone or Skystone) Delivered by going under the corresponding **Alliance Skybridge** for the **Robot** is worth one (1) point to the **Alliance** that Delivered the **Stone**. Stones Delivered under the **Alliance** neutral Skybridge are worth zero (0) points for this task. Stones Returned deduct one (1) point each for the **Alliance** who Returned the **Stone**.

   Note: Points are given only when both the **Robot** and the **Stone** it Controls cross completely from the **Loading Zone** to the **Building Zone**. The intent of this rule is to not allow **Robots** using arms to push a **Stone** through, “kickers”, or any other method that does not require the **Robot** to pass completely under the corresponding **Alliance Skybridge**.
2) **Placing** – At the end of the *Match*, each *Stone* (*Stone or Skystone*) that is *In* the *Foundation* and not in contact with an *Alliance Robot* when all *Scoring Elements* have come to rest earns one (1) point.

3) **Skyscraper Bonus** – An *Alliance* will earn two (2) points for each *Skyscraper Level* of their tallest *Skyscraper* that is not in *Contact* with an *Alliance Robot* when all *Scoring Elements* have come to rest after the *End* of the *Driver-Controlled Period*. If there are multiple *Skyscrapers* at the same height, only one *Skyscraper Bonus* will be earned.

Note: *Teams* may move their *Foundation* into their *Building Site* during the *Driver-Controlled Period* before the start of the *End Game*, so that they are eligible for the *Foundation Moved* (*End Game*) points, but they do not earn any *Repositioning* (*Autonomous*) points for the action.

### 4.5.4 End Game

The last thirty seconds of the *Driver-Controlled Period* is called the *End Game*. *Driver-Controlled Period Scoring* can still take place during the *End Game*. Except for *Parking*, *End Game* tasks completed prior to the start of the *End Game* will earn zero (0) points for those tasks.

Points are awarded at the end of the *Match* for the following *End Game* achievements:

1) **Capping** – An *Alliance* will earn points for placing a *Capstone On* their *Foundation* or any *Skyscraper* on their *Alliance’s Foundation*. A *Robot* cannot be in contact with the *Capstone* in order for the points to count. The points are awarded as follows:

   a) Five (5) points for each *Capstone* that is fully *Supported On* a *Skyscraper* or *Foundation*. A *Capstone* may be placed *On* another legally scored *Capstone* and still earn points.

   b) One (1) point for each *Level* that *Supports* a *Capstone*. Note: If placed onto another *Capstone*, the lower *Capstone* does not count as a *Level*.

   c) Multiple *Capstones* on the same *Skyscraper* will each earn points.

   d) A *Robot* may only *Score* one (1) *Capstone*.

2) **Foundation Moved** – An *Alliance* will earn fifteen (15) points if their *Foundation* has been moved *Completely Out* of the *Building Site* by the *End of the Match*. The *Foundation* must have been *In* the *Building Site* at the start of *End Game* in order to earn these points.

3) **Parking** - An *Alliance* will earn five (5) points for each *Robot* that is *Parked In* their *Alliance’s Building Site* at the end of the *Match* (*T=0:00*).

Note: Due to the possibility that *Skyscrapers* may fall when *Robots* try to move the *Foundation*, the *Skyscraper, Placing*, and *Capstone* achievements will be *Scored* once all *Scoring Elements* have come to rest following the end of the *Match*.

### 4.5.5 Post Match

After the *Match*, field personnel will finalize the *Score*. Referees will signal for the *Drive Teams* to enter the *Playing Field* and retrieve their *Robots* and *Capstones*. *Drive Teams* should return any *Stones* that are *Possessed* by the *Robot* to the *Playing Field*. The *Playing Field* reset crew will set up the *Playing Field* for the next *Match*.

### 4.5.6 Penalty Scoring

*Penalty* points are added to the non-offending *Alliance’s Score* at the end of the *Match*. *Minor Penalties* give the non-offending *Alliance* five (5) points per occurrence. *Major Penalties* give the non-offending *Alliance* twenty (20) points per occurrence.

Section 4.0 – The Game
4.5.7 Flowchart of Match Play
The following figure shows the flow of the Match and the actions taken on the Driver’s Station Android device.

4.6 Rules of Gameplay
Gameplay is restricted by the Safety rules (<S#>), the General rules (<G#>), and the Game-Specific rules (<GS#>). Other rules to pay close attention to are the Robot rules, Capstone rules, the inspection rules, and the tournament rules defined in the Game Manual Part 1. Violation of rules may lead to Penalties, Yellow Cards and/or Red Cards, a Disabled Robot, Disqualification of the offending Team and/or Alliance from either a Match or the tournament. Rules apply to all periods of play unless specifically called out otherwise. If rules are in conflict, Safety rules take precedence over all rules and Game-Specific rules take precedence over General rules. The official FIRST Tech Challenge Question & Answer Forum rulings take precedence over all information in the game manuals.

4.6.1 Safety Rules
<S1> Unsafe Robot or Playing Field Damage – If at any time the Robot operation is deemed unsafe or has damaged the Playing Field or another Robot, by the determination of the referees, the offending Robot may be Disabled, and the Team may be issued a Yellow Card. Re-inspection of the Robot is required before it may play another Match. Damage that requires significant repair and/or delays subsequent Match play is likely to escalate to a Red Card.

The intent of this rule is to immediately stop unsafe Robot actions or Playing Field Damage that is likely to persist with continued Robot operation. Robots that can continue safe operation without damaging the Playing Field will receive a warning and may continue to play the Match. Robots will be Disabled for unsafe operation or Playing Field Damage that occurs after the first warning for the tournament. Damage that affects gameplay is likely to escalate to a Yellow Card.
<S2> Robot Extension Outside the Playing Field Perimeter – If any portion of the Robot contacts anything Outside the Playing Field Perimeter, the Team will be issued a Yellow Card and it may be Disabled immediately for the remainder of the Match, unless allowed by Game-Specific rule(s) listed in section 4.6.3. See the game definitions in section 4.4 for a complete description of the Playing Field Perimeter.

The intent of this rule is not to Penalize an Alliance for Inadvertent, safe Robot extension Outside the Playing Field Perimeter. Intentional Robot extension Outside the Playing Field is not permitted, except as allowed by game-specific rules listed in section 4.6.3.

4.6.2 General Game Rules

<G1> Drive Team – Each Drive Team shall include up to two Drivers, one Coach, and one Human Player (however only one Human Player may represent an Alliance). Electronic communications (cell phone, two-way radio, Wi-Fi, Bluetooth, etc.) by Drive Team members after an Alliance has been called from the queue to the Playing Field for its Match are not allowed. The first instance of violating this rule will result in a warning, with any following instances during the tournament resulting in a Minor Penalty. Items that may be mistaken by a casual observer as being in violation should not be brought to the Playing Field. The Driver Station is exempt from this rule but must be used only for operating the Robot.

<G2> Playing Field Access - Team members cannot enter the Playing Field for any reason other than to place/retrieve their Robots. Teams may not measure, test, or adjust Field or Game Elements. Inspection of the Playing Field elements by Team members to determine Scoring is not allowed. The consequences for violating this rule are:

a) Minor Penalty for violation of this rule during Match setup or following the end of the Match.

b) Major Penalty for violations of this rule that delay the start of the Match.

c) Violations of this rule outside of normal Match play result in a Yellow Card.

If a Team feels the Playing Field is not set up correctly, Teams should notify a Referee or FTA prior to the start of the Match.

<G3> Pre-Match Robot Placement – At the beginning of a Match, each Alliance Robot must be set up on the Playing Field according to section 4.5.1 Pre-Match in the Game Manual Part 2. After Robots are set up on the Playing Field, Drive Teams must stand Completely Inside their respective Alliance or Human Player Station.

a) During the Qualification Matches, the blue Alliance Robots are set up on the Playing Field first, unless the red Alliance waives their right to set up on the Playing Field second.

b) During the Elimination Matches, the 3rd and 4th seeded Alliance Robots are set up on the Playing Field first, unless the higher seeded Alliance waives their right to set up on the Playing Field second. Alliance color doesn’t change the seeding of a Team during the Elimination Matches. If the 4th seed defeats the
1st seed in the Semi-Finals, they will still have to place their Robot on the field first in the Finals because their seeding will be lower than the 2nd or 3rd seed.

c) During Elimination Matches, 3 Team Alliances may only place Robots that are intended to compete in that Match. Once two Robots are placed for the two Teams competing in a Match, the Alliance cannot swap in the 3rd Alliance’s Robot for a Robot already placed.

d) Teams may implicitly waive their right to place their Robots on the Playing Field last by placing their Robots on the Playing Field before or with the opposing Alliance. There is no need to tell the referees; Teams waive their right by the act of placing their Robots on the Playing Field.

e) Teams that unnecessarily delay the beginning of a Match and/or field reset will incur a Minor Penalty for each offense.

Drive Teams are expected to stage their Robots for a Match, and remove it from the Playing Field afterwards, safely and swiftly. Drive Team efforts that either intentionally or unintentionally delay the start of a Match or the Playing Field reset are not allowed. Examples include, but are not limited to:

- Late arrival to the Playing Field.
- Robot maintenance once on the Playing Field.

<G4> Robot Starting Volume – Before the start of a Match, each Robot in its starting location must not exceed a volume of 18 inches (457.2 mm) by 18 inches (457.2 mm) by 18 inches (457.2 mm) unless otherwise allowed or restricted by Game Specific Rules detailed in section 4.6.3. The Pre-Loaded Scoring Element may extend Outside the 18-inch (457.2 mm) cube volume constraint. An offending Robot will be removed from the Playing Field, is considered a no-show, and receives no Ranking and TieBreaker Points for the Match.

After the start of a Match, the Robot may extend in any dimension unless restricted by the Game-Specific rules detailed in section 4.6.3.

<G5> Robot Setup/Alignment – Teams may align their Robots during Pre-Match setup if they do so with legal components that are part of the Robot and can be reset to be within the 18-inch (457.2 mm) cube starting volume constraint. A single member of the Drive Team may also align the Robot by sight if they are next to the Robot and does not delay the start of a Match. A Minor Penalty will be assessed to the Team for violation of this rule.

<G6> Alliance and Human Player Stations – During a Match, the Drivers, Coaches, and Human Players must remain In their Stations.

a) The first instance of leaving the Station will result in a warning, with any following instances resulting in a Minor Penalty. Leaving the Station for safety reasons will not result in a warning or Penalty.
b) Opposing Alliances’ Drive Teams on the same side of the Field cannot distract and/or interfere with each other nor of the off-field Scoring Elements. Violation of this rule will result in an immediate Major Penalty and a possible Yellow Card.

The Intent of this rule is to prevent Team members from leaving their assigned Station during a Match to gain a competitive advantage. For example; moving to another part of the Field for better viewing, reaching into the Field, etc. Simply breaking the plane of the Station during normal Match play is not a Penalty.

<G7> Starting Gameplay Early – Robots that start playing the game (Autonomous or Driver-Controlled Period) prior to the start of a Match Period receive a Minor Penalty. Referees have the option of issuing a Major Penalty in place of the Minor Penalty if the early start results in a competitive advantage for the offending Alliance.

<G8> Late Start of the Autonomous Period – Teams participating in the Autonomous Period are expected to press the "start with 30-second" button on their Driver Station Android device and then place the Driver Station in a hands-off location without delay when field personnel signal the start of the Autonomous Period. A Minor Penalty is assessed for violating this rule. Referees have the option of issuing a Major Penalty in place of the Minor Penalty if the late start results in a competitive advantage for the offending Alliance.

<G9> Robot Control During Autonomous Period - During the Autonomous Period, Drive Teams may not directly or indirectly control or interact with Robots or Driver Stations. Early stopping of the Robot while running its Autonomous code is not allowed, except in cases of personal or equipment safety. A Major Penalty will be assessed for violating this rule.

<G10> Parked – Robots must Park at the end of the Autonomous and Driver-Controlled Periods when competition personnel or timer software announce the end of a Match period. Drive Teams should make their best effort to stop gameplay immediately when the End of the Period game sound begins. Robots that are not Parked following an approximate one second grace period after the conclusion of the game sound receive a Minor Penalty and the actions of the Robot do not count towards their Alliance’s Score. Referees have the option of issuing a Major Penalty in place of the Minor Penalty if the late stop results in a competitive advantage (other than Scoring) for the offending Alliance.

Scoring Elements that were Launched (unless disallowed by Game Specific rules) before the End of the Period are eligible to be counted as Scored. Other Robot Scoring achievements that occur after the announced end of the Autonomous Period and before the start of the Driver-Controlled Period do not count towards the Score for the Autonomous or Driver-Controlled Periods.

<G11> Drive Team Contact with the Playing Field or Robot – During a Match, the Drive Team is prohibited from making contact with the Playing Field, any Robot, or any Game Element (except for allowed Human Player activities). The first instance of contact will result in a warning, with any following instances resulting in a Minor Penalty. Contact that affects Scoring and/or gameplay will result in issuance of a Yellow Card at the discretion of the referees. Contact with the Playing Field, a Game Element, or a Robot for safety reasons will not result in a warning or Penalty.

For example, a Game Element is launched from a Robot on the Playing Field and it Inadvertently hits a Team member in the Alliance Station and is deflected back onto the field. The Team would not receive a Penalty because the Team member was protecting him/herself (safety). However, if that same Game Element is caught and/or directed to a specific location on the Playing Field, the Team may be issued a Penalty.
<G12> Autonomous to Driver-Controlled Period Transition – At the conclusion of the Autonomous Period, Robots will remain in a hands-off state. Field personnel will not enter the field and will not touch Robots on the field during the Autonomous to Driver-Controlled transition. Drive Teams will have 5 seconds to pick up their Driver Station. The scoring system display will provide visual and audio cues for Drive Teams to pick up their Driver Stations. After the 5 seconds, there will be a 3-2-1 countdown and the Driver-Controlled Period of the Match will begin.

<G13> Drive Team Coach Driver Station Control – During the Driver-Controlled Period, Robots must be remotely operated only by the Drivers using the Gamepads connected to the Team’s Driver Station and/or by software running on the on-board Robot control system. The first instance of Coach controlling a Robot (for example, operating a Gamepad) will result in a warning, with any following instances resulting in a Major Penalty. During the Driver-Controlled Period, Drive Team Coaches and/or Drivers are allowed to hold the Team’s Driver Station Android device and interact with it to select an Op Mode, view information displayed on the screen, and initialize, start, stop, and reset the Robot.

<G14> Certifying the Score at Match End – Scores will be tracked by field personnel throughout the Autonomous and Driver-Controlled Periods of the Match. At the end of the Match, the final Score will be certified as quickly as possible. A change in state of a Game Element or Robot at the end of the Match after its final Score is recorded will not change an already-recorded Score. Scoring Elements will not be recounted at the end of the Match.

<G15> Robots Deliberately Detaching Parts – Robots may not deliberately detach parts during a Match or leave mechanisms on the Playing Field unless permitted by a Game Specific Rule. Possessed or Controlled Scoring Elements are not considered to be a part of the Robot for the purpose of this rule. The consequence of deliberately detaching a part is a Minor Penalty if it does not Block an opposing Alliance Robot, Alliance-specific Scoring Element or Scoring Area. If a deliberately detached component or mechanism affects gameplay by any Robot, the offending Robot will receive a Major Penalty and will be issued a Yellow Card. Robot parts that are released but remain connected by a tether are considered detached for the purposes of this rule.

Tethered components that move independently of the main Robot are considered a detached component and are illegal.

<G16> Robots Grasping Game Elements – Robots may not grab, grasp and/or attach to any Game Element, Robot, or structure other than Scoring Elements, unless specifically allowed by game-specific rule(s) listed in section 4.6.3. The first instance will result in a warning with any following violations resulting in a Major Penalty.

<G17> Destruction, Damage, Tipping, etc. – Robot actions aimed at the destruction, damage, tipping over, or entanglement of Robots or Game Elements are not in the spirit of the FIRST Tech Challenge and are not allowed unless permitted by Game Specific rules. However, FIRST Tech Challenge games are highly interactive. Robot-to-Robot contact and defensive gameplay should be expected. Some tipping, entanglement, and damage may occur as a part of normal gameplay. If the tipping, entanglement, or damage is ruled to be deliberate or chronic, the offending Team will receive a Major Penalty and a Yellow Card.

<G18> Pinning, Trapping, or Blocking Robots – A Robot cannot cause an opposing Alliance Robot to become Pinned, Trapped, or Blocked. If a referee determines this rule is violated, the offending Alliance will receive a Minor Penalty for every five seconds that they are in violation. If a referee declares a Pinning, Trapping, or Blocking warning during the Match, the offending Robot must immediately move away at least 3 feet (0.9 m), approximately 1.5 floor Tiles, from the Pinned, Trapped, or Blocked Robot.
A **Robot** cannot incur this type of **Penalty** during the **Autonomous Period** unless it is determined by the **Referee** to be part of a deliberate strategy and will be penalized as described above. If the violation happens during the **Autonomous Period**, the first action done by the offending **Robot** during the **Driver-Controlled Period** must be to move away from the **Pinned**, **Trapped**, or **Blocked Robot** or a **Minor Penalty** will be assessed immediately and again for every five-seconds that they are in violation. Game-specific rule(s) listed in section 4.6.3 that further define **Pinning**, **Trapping**, or **Blocking** take precedence over this general game rule.

**The intent of this Rule is that Drive Teams begin to immediately move their Robots away and have a five second grace period to move the required distance, and not that they are permitted to intentionally Block for up to five seconds.**

**<G19> Forcing an Opponent to Break a Rule** — The actions of an **Alliance** or their **Robots** shall not cause an opposing **Alliance** or **Robot** to break a rule and thus incur **Penalties**. Any forced rule violations committed by the affected **Alliance** shall be excused, and no **Penalties** will be assigned.

**<G20> Removing Game Elements from the Playing Field** — **Robots** may not deliberately remove Game Elements from the **Playing Field** during a **Match**. Game Elements that **Inadvertently** fall **Outside** the **Playing Field** will be returned to the **Playing Field** by field personnel at the earliest safe and convenient opportunity at a non-**Scoring** location approximately where it left the field. Game Elements removed from the **Playing Field** in an attempt to **Score** are also not subject to this **Penalty**. Teams deliberately removing Game Elements from the **Playing Field** will incur a **Minor Penalty** per **Game Element** removed from the **Playing Field**. Game-specific rule(s) listed in section 4.6.3 that allow the removal of specified **Scoring Elements** from the **Playing Field** take precedence over this general game rule.

**<G21> Scoring Elements in Contact with Robots** — **Scoring Elements** in a **Scoring Area** that are in contact with or **Controlled** by a **Robot** on the corresponding **Alliance** for the **Scoring Area** have zero **Score** value. Game-specific rule(s) listed in section 4.6.3 that allow **Robot** contact with **Scoring Elements** take precedence over this general game rule.

**<G22> Post-Match Removal of Game Elements from Robots** — **Robots** must be designed to permit easy removal of **Game Elements** from the **Robot** after the **Match**. **Robots** should also be able to be removed from the **Playing Field** without damaging the **Playing Field**. A **Minor Penalty** will be assessed for violations of this rule.

The intent of this rule is to have timely removal of **Robots** from the **Playing Field** following a **Match**.

**Drive Teams** are expected to stage their **Robots** for a **Match**, and remove them from the **Playing Field** afterwards, safely and swiftly. **Drive Team** efforts that either intentionally or unintentionally delay the start of a **Match** or the **Playing Field** reset are not allowed. Examples include, but are not limited to:

- Failing to exit the **Playing Field** once instructed by a Referee.
- Failing to remove **Driver Stations** in a timely manner.

**<G23> Robot Manipulation of Scoring Elements** — **Scoring Elements** that are **Controlled** or **Possessed** by a **Robot** are part of the **Robot** except when determining the location of the **Robot**.

For Example: If a **Robot** possesses a **Scoring Element**, and only that **Scoring Element** breaks the plane of a **Scoring Area**, the **Robot** does not receive points for being **In** that **Area**.
Robot or Scoring Elements In Two or More Scoring Areas – Robots or Scoring Elements that are in two or more Scoring Areas earn points only for the highest value achievement. If the achievement values are equal, only one achievement counts as Scored. Exceptions to this general rule may be specified in the Gameplay section (4.5) or in the game-specific rules.

Disabled Robot Eligibility - If a referee Disables a Robot, it will not be eligible to Score or earn points for the remainder of the Match. A Disabled Robot (whether referee induced or failure) does not earn Penalties after becoming Disabled. Game-specific rule(s) listed in section 4.6.3 take precedence over this general game rule.

Playing Field Tolerances – Tournament provided Playing Field and Game Elements will start each Match with tolerances that may vary by as much as +/-1.0 inch (25.4 mm). Teams must design their Robots accordingly.

Match Replay – Matches are replayed at the discretion of the Head Referee only for a failure of a non-Team supplied Game or Field Element or verified Wi-Fi interference that was likely to have impacted which Alliance won the Match.

Unexpected Robot behavior will not result in a Match replay. Team-induced failures, such as low battery conditions, processor sleep time-outs, Robot mechanical, electrical, software, or communication failures, etc. are NOT valid justifications for a replaying of a Match.

Egregious Behavior – Egregious Robot or Team member behavior at the Playing Field, as determined by the referees, will result in a Major Penalty and issuance of a Yellow Card and/or Red Card. Subsequent violations will result in Team Disqualification from the tournament. Egregious behavior includes, but is not limited to, repeated and/or flagrant violation of game rules, unsafe behavior or actions, and uncivil behavior towards Drive Team, competition personnel, or event attendees.

Illegal Usage of Game Elements - Robots may not deliberately use Game Elements to ease or amplify the difficulty of any Scoring or game activity. A Major Penalty will be assessed for violations of this rule. Continued violations of this rule will escalate to Yellow Cards quickly.

Inadvertent and Inconsequential - Robot actions that violate a rule may be ruled at the referee’s discretion to be Inconsequential and Inadvertent and will not be Penalized.

4.6.3 Game-Specific Rules

Human Player Supplied Stones and Capstones – The Human Player may deliver Stones or Capstones into their Alliance’s Depot only during the Driver-Controlled Period with the following restrictions:

a) Only one Scoring Element may be Delivered at a time.

b) A Human Player may not Deliver Stones and/or Capstones prior to the start of the Driver-Controlled Period.

c) Stones and Capstones may only be hand-delivered to the Alliance’s Depot. Teams may not bring tools or devices to the Playing Field for handling the Stones or Capstones. Accommodations and exceptions for a Human Players with disabilities or extenuating circumstances will be made at the discretion of the event coordinator.

d) A Human Player cannot break the vertical plane of the Perimeter Wall when there is a Robot or Scoring Element already in the Depot.

e) A Human Player cannot hand-deliver a Stone or Capstone into the Playing Field when there is a Robot or Scoring Element already in the Depot.
f) Any Stones that are hand-delivered by the Human Player from the Stone Supply during Autonomous are not eligible to receive points.

g) Stones and/or Capstones must be In the Depot and Completely On the Playing Field floor prior to being Controlled by a Robot.

Note: A Disabled Robot In an Alliance Depot is not considered a safety hazard to the Human Player, therefore Stones and Capstones may continue to be placed. The rule <GS6> Yellow Card consequence applies to the Disabled opposing Alliance Robot In the Depot.

Violations of <GS1> result in a Minor Penalty per occurrence.

The intent of this rule is to prevent Robot to human contact and is meant to ensure Human Player safety.

<GS2> Autonomous Period Interference – During the Autonomous Period, Robots may not interfere with the opposing Alliance’s Scoring attempts or contact/disrupt the Stones or Skystones in the opposing Alliance’s Quarry. A Major Penalty will be assessed for each violation of this rule and any Scoring by the offending Robot that occurs using the opposing Alliance’s Game Elements will not benefit the offending Alliance.

<GS3> Control/Possession Limits of Stones/Capstones – Once a Match begins; a Robot may Control or Possess a maximum of one (1) Stone and/or one (1) Capstone.

a) Plowing through any quantity of Stones or Capstones is allowed but herding or directing multiple Stones or Capstones to gain a strategic advantage (i.e., Scoring, accessibility, defense) is not allowed. The Penalty for Controlling or Possessing more than the allowed quantity is an immediate Minor Penalty for each Stone or Capstone above the limit plus an additional Minor Penalty per Stone or Capstone for each 5-second interval that this situation continues. A double Major Penalty will be assessed for each Stone or Capstone Scored while a Robot Controls or Possesses more than the allowed quantity. Continued violation of this rule will escalate to Yellow Cards quickly.

b) Stones and Capstones In the Foundation are exempt from the Control/Possession Limit.

c) Controlling or Possessing an opposing Alliance’s Capstone is a Major Penalty.

<GS4> Launching of Game Elements – Game Elements may not be Launched by a Robot or Human Player. A Minor Penalty will be assessed for every Launched Game Element.

<GS5> Foundation Scoring Interference – Robots may not be In their opposing Alliance’s Foundation at any time. Robots may not interfere with an opposing Alliance Robot that is In their Foundation. The first instance will result in an immediate Major Penalty and an additional Minor Penalty assessed for every five seconds that the rule violation persists. Additional occurrences of violations of this rule will escalate to Yellow Cards quickly.

The intent of this rule is to prevent game strategies aimed at interfering with Scoring and not for Inadvertent and Inconsequential intrusion.

<GS6> Blocking Access to the Depot – Robots may not be In or Block access to the opposing Alliance’s Depot. Inconsequential violations of this rule during the Autonomous Period will be handled per rule <G30>. The first instance will result in a warning with any following violations resulting in a Major Penalty and an additional Minor Penalty assessed for every five seconds that the rule violation persists. If the referee declares a Blocking access warning, the offending Robot must move away at least 3 feet (0.9 m), approximately 1.5 floor Tiles from the Blocked Depot. Failure to move the required 3 feet (0.9 m) within 5 seconds is considered
an additional violation and will incur the Penalties described above. Additional occurrences of violations of this rule will escalate to Yellow Cards quickly.

Note: A Disabled Robot In a Depot is not considered a safety hazard, therefore Stones and Capstones may continue to be placed. However, a Disabled Robot In the opposing Alliance’s Depot still earns a Yellow Card due to the possibility of a severe disruption to the ability of the owner of the Depot to play the game.

The intent of this rule is to allow Robot access to and from their Alliance’s Depot. See definition of Blocking and Trapping in section 4.4.

<GS7> Skybridge Specific Penalties –

a) Robots may not grab, grasp, or hang on the Skybridge pipes. Each occurrence will result in a Major Penalty.

b) Robots may not move from one Zone to another via the opposing Alliance’s Skybridge section. Each occurrence will result in an immediate Major Penalty.

c) Robots may not prevent an Opposing Alliance Robot from moving between one Zone to another via the Neutral Skybridge. This is considered Blocking and will be penalized per <G18>.

<GS8> Controlling the Opposing Alliance’s Foundation – Robots may not Control the opposing Alliance’s Foundation when the Foundation is In the opposing Alliance’s Building Site or at any time during End Game. The first instance will result in an immediate Major Penalty and an additional Minor Penalty assessed for every five seconds that the rule violation persists. Additional occurrences of violations of this rule will escalate to Yellow Cards quickly.

<GS9> Descoring – Robots may not remove or reposition Stones/Capstones from their opposing Alliance’s Foundation when the Foundation is In the opposing Alliance’s Building Site or at any time during End Game. A double Minor Penalty will be assessed for each Stone that is de-scored. If a Capstone is de-scored, a Major Penalty will also be assessed.

Drive Teams should exercise care when operating around an opposing Alliance’s Foundation to avoid De-scoring.

<GS10> Foundation Movement – Foundations must remain Completely In the Building Zone. A Minor Penalty will be assessed for every 5 seconds that the Foundation is not Completely In the Building Zone.

<GS11> Skybridge Safety – Never step/jump over any section of the Skybridge. The first instance will result in a warning to the entire Team. The next instance will be a Minor Penalty. The next instance will be a Major Penalty. Further violations beyond will be considered Egregious Behavior.

<GS12> Drive Teams Touching Robots or Driver Stations after Quarry Randomization – Drive Teams are not allowed to touch or interact with their Robots or Driver Station once field personnel have begun the randomization process. If this occurs, a Minor Penalty will be assessed, and the affected Robot is not eligible to earn the Stone Delivery Score in the Autonomous Period. This Penalty only affects the offending Team. The non-offending Alliance partner Robot remains eligible for the Stone Delivery Scoring achievement.
4.7 Scoring Summary

The following table shows the possible Scoring achievements and their point values. The table is a quick reference guide and not a substitute for a thorough understanding of the game manual.

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<td>Repositioning</td>
<td>10 1</td>
<td>- 4</td>
<td>4.5.2.4 4.5.3.2</td>
<td>End of Period</td>
<td></td>
</tr>
<tr>
<td>Placing</td>
<td>4 1</td>
<td>- -</td>
<td>4.5.2.3</td>
<td>End of Period</td>
<td></td>
</tr>
<tr>
<td>Navigating</td>
<td>5</td>
<td>- -</td>
<td>4.5.2.1</td>
<td>End of Period</td>
<td></td>
</tr>
<tr>
<td>Driver-Controlled Stone Deliveries</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>4.5.3.1</td>
<td>As it occurs</td>
</tr>
<tr>
<td>Tallest Skyscraper Bonus</td>
<td>- 2 per Skyscraper Level</td>
<td>-</td>
<td>4.5.3.3</td>
<td>End of Match</td>
<td></td>
</tr>
<tr>
<td>Capping</td>
<td>- -</td>
<td>5</td>
<td>4.5.4.1a</td>
<td>End of Match</td>
<td></td>
</tr>
<tr>
<td>Capping Bonus</td>
<td>- -</td>
<td>1 per Skyscraper Level</td>
<td>4.5.4.1b</td>
<td>End of Match</td>
<td></td>
</tr>
<tr>
<td>Foundation moved out of Building Site</td>
<td>- -</td>
<td>15</td>
<td>4.5.4.2</td>
<td>End of Match</td>
<td></td>
</tr>
<tr>
<td>Parking</td>
<td>- -</td>
<td>5</td>
<td>4.5.4.3</td>
<td>End of Match</td>
<td></td>
</tr>
</tbody>
</table>

4.8 Rule Summary

The following table shows the possible rule violations and their consequences. The table is a quick reference guide and not a substitute for a thorough understanding of the complete rule descriptions in section 4.6.

<table>
<thead>
<tr>
<th>Rule #</th>
<th>Rule</th>
<th>Consequence</th>
<th>Warning</th>
<th>Disable</th>
<th>Minor Penalty</th>
<th>Major Penalty</th>
<th>Card Issued</th>
</tr>
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<tbody>
<tr>
<td>Safety Rules</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;S1&gt;</td>
<td>Unsafe Robot or Damage to the Playing Field.</td>
<td>Disable if unsafe operation is likely to persist. Optional Yellow Card. Significant damage and/or delays may escalate to Red Card.</td>
<td>W</td>
<td>D</td>
<td></td>
<td></td>
<td>YC* RC*</td>
</tr>
<tr>
<td>&lt;S2&gt;</td>
<td>Contact Outside the Playing Field.</td>
<td>Immediate Yellow Card and Optional Disable unless allowed by rule.</td>
<td>D*</td>
<td></td>
<td></td>
<td>YC</td>
<td></td>
</tr>
<tr>
<td>Rule #</td>
<td>Rule</td>
<td>Consequence</td>
<td>Warning Disable</td>
<td>Minor Penalty</td>
<td>Major Penalty</td>
<td>Card Issued</td>
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</tr>
<tr>
<td>&lt;S3&gt;</td>
<td><em>Drive Team</em> missing safety gear.</td>
<td>Warning and if not resolved within 30 seconds, the offending member(s) of the <em>Drive Team</em> must leave the <em>Competition Area</em> and may not be replaced.</td>
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<td>W</td>
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</table>

### General Rules

<table>
<thead>
<tr>
<th>Rule #</th>
<th>Rule</th>
<th>Consequence</th>
<th>Warning Disable</th>
<th>Minor Penalty</th>
<th>Major Penalty</th>
<th>Card Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;G1&gt;</td>
<td><em>Drive Team</em> using disallowed electronic communication.</td>
<td>Warning followed by a <em>Minor Penalty</em>.</td>
<td>W</td>
<td>1x</td>
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</tr>
<tr>
<td>&lt;G4&gt;</td>
<td><em>Robot</em> starting volume.</td>
<td><em>Robot</em> is <em>Disabled</em>, powered off, and removed from the <em>Playing Field</em>. <em>Team</em> is considered a no-show.</td>
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<td>D</td>
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</tr>
<tr>
<td>&lt;G5&gt;</td>
<td><em>Robot</em> setup alignment devices/Match Delay.</td>
<td><em>Minor Penalty</em> for each offense.</td>
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</tr>
<tr>
<td>&lt;G6&gt;</td>
<td>a) <em>Drive Team</em> member(s) leaving the <em>Alliance Station</em>.</td>
<td>Warning for the first instance with any following instances resulting in a <em>Minor Penalty</em>.</td>
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<td>W</td>
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<tr>
<td></td>
<td>b) Opposing <em>Alliances’ Drive Teams</em> on the same side of the <em>Field</em></td>
<td>Immediate <em>Major Penalty</em> and a possible <em>Yellow Card</em>.</td>
<td></td>
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<td>YC*</td>
</tr>
<tr>
<td></td>
<td>distracting and/or interfering with each other or the off-Field</td>
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<td>1x</td>
</tr>
<tr>
<td></td>
<td>Scoring Elements.</td>
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</tr>
<tr>
<td>&lt;G7&gt;</td>
<td><em>Starting Gameplay Early</em>.</td>
<td><em>Minor Penalty</em> with the option of a <em>Major Penalty</em> if the early start results in a competitive advantage for the offending <em>Alliance</em>.</td>
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<td>1x</td>
<td>1x</td>
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<tr>
<td>&lt;G8&gt;</td>
<td><em>Late Start of the Autonomous Period</em>.</td>
<td><em>Minor Penalty</em> with the option of a <em>Major Penalty</em> if the late start results in a competitive advantage for the offending <em>Alliance</em>.</td>
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<td>1x</td>
<td>1x</td>
</tr>
<tr>
<td>&lt;G9&gt;</td>
<td><em>Robot</em> control during Autonomous Period / Early stopping of</td>
<td><em>Major Penalty</em>.</td>
<td></td>
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<tr>
<td></td>
<td>Autonomous code.</td>
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<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;G10&gt;</td>
<td><em>Robot</em> is not <em>Parked</em> at end of period.</td>
<td><em>Minor Penalty</em> and the actions of the <em>Robot</em> that occur after the end of gameplay do not count towards their <em>Alliance’s Score</em>. <em>Major Penalty</em> if the late stop results in a competitive advantage for the offending <em>Alliance</em>.</td>
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<td>1x</td>
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<tr>
<td>Rule #</td>
<td>Rule</td>
<td>Consequence</td>
<td>Warning Disable</td>
<td>Minor Penalty</td>
<td>Major Penalty</td>
<td>Card Issued</td>
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<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>&lt;G11&gt;</td>
<td>Drive Team contact with the Playing Field, Game Element, or Robot.</td>
<td>Warning for the first instance with any following instances resulting in a Minor Penalty. Optional Yellow Card if contact affects Scoring and/or gameplay.</td>
<td>W</td>
<td>1x</td>
<td></td>
<td>YC*</td>
</tr>
<tr>
<td>&lt;G13&gt;</td>
<td>Drive Team Coach Driver Station Control.</td>
<td>Warning for the first instance with any following instances resulting in a Major Penalty.</td>
<td>W</td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G15&gt;</td>
<td>Robots deliberately detaching parts.</td>
<td>Minor Penalty. Major Penalty and a Yellow Card if it affects gameplay.</td>
<td></td>
<td>1x</td>
<td>1x</td>
<td>YC</td>
</tr>
<tr>
<td>&lt;G16&gt;</td>
<td>Robots illegally grasping Game Elements.</td>
<td>Warning for the first instance with any following instances resulting in a Major Penalty.</td>
<td>W</td>
<td>1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G17&gt;</td>
<td>Destruction, damage, tipping, etc.</td>
<td>Deliberate or chronic violations of this rule will receive a Major Penalty and a Yellow Card.</td>
<td></td>
<td></td>
<td>1x</td>
<td>YC</td>
</tr>
<tr>
<td>&lt;G18&gt;</td>
<td>Pinning, Trapping, or Blocking for more than 5-seconds in the Driver-Controlled Period.</td>
<td>Minor Penalty for every five seconds the Robot violates this rule.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;G20&gt;</td>
<td>Deliberately removing Game Elements from the Playing Field.</td>
<td>Minor Penalty per Game Element deliberately removed from the Playing Field.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;G21&gt;</td>
<td>Scoring Elements in contact or Controlled with Robots of the corresponding Alliance.</td>
<td>Points are not earned for any Scoring Elements in contact with Robots of the corresponding Alliance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;G22&gt;</td>
<td>Delay caused by removal of Robots from the Playing Field and Game Elements from Robots.</td>
<td>A Minor Penalty will be assessed.</td>
<td></td>
<td></td>
<td>1x</td>
<td></td>
</tr>
<tr>
<td>&lt;G28&gt;</td>
<td>Egregious behavior.</td>
<td>Major Penalty plus a Yellow and/or Red Card. Possible Match Disqualification. Subsequent violations result in Team Disqualification for the tournament.</td>
<td></td>
<td></td>
<td></td>
<td>YC RC DQ</td>
</tr>
<tr>
<td>&lt;G29&gt;</td>
<td>Illegal Use of Game Elements to ease or amplify Scoring.</td>
<td>Major Penalty will be assessed with any following instances resulting in a Yellow Card.</td>
<td></td>
<td></td>
<td>1x</td>
<td>YC</td>
</tr>
</tbody>
</table>

**Game-Specific Rules**

<table>
<thead>
<tr>
<th>Rule #</th>
<th>Rule</th>
<th>Consequence</th>
<th>Warning Disable</th>
<th>Minor Penalty</th>
<th>Major Penalty</th>
<th>Card Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;GS1&gt;</td>
<td>Illegal introduction of Stones and Capstones.</td>
<td>Minor Penalty per occurrence.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;GS2&gt;</td>
<td>Interference with opposing Alliance Scoring during Autonomous.</td>
<td>Major Penalty will be assessed and Scoring will not count during occurrence.</td>
<td></td>
<td></td>
<td>1x</td>
<td>Pts</td>
</tr>
<tr>
<td>Rule #</td>
<td>Rule</td>
<td>Consequence</td>
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</tr>
<tr>
<td>&lt;GS3&gt;</td>
<td>1) <strong>Control / Possession</strong> limits of Stones. 2) <strong>Control or Possessing</strong> an opposing Alliance Capstone</td>
<td>Immediate <em>Minor Penalty</em> per Stone plus an additional <em>Minor Penalty</em> per five seconds. <em>Double Major Penalty</em> if Stone is <em>Scored</em>. May escalate to <em>Yellow Card</em>.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><em>Major Penalty</em></td>
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</tr>
<tr>
<td>&lt;GS4&gt;</td>
<td>Launching Game Elements.</td>
<td><em>Minor Penalty</em> per occurrence.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>&lt;GS5&gt;</td>
<td>Foundation Scoring Interference.</td>
<td><em>Major Penalty</em> is assessed plus an additional <em>Minor Penalty</em> per 5 seconds in violation. May escalate to <em>Yellow Card</em>.</td>
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<td>1x+ 1x YC*</td>
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<tr>
<td>&lt;GS6&gt;</td>
<td>Blocking access to opposing Alliance’s Depot.</td>
<td>Warning for the first instance with any following instances resulting in a <em>Major Penalty</em>, plus an additional <em>Minor Penalty</em> per 5 seconds in violation. May escalate to <em>Yellow Card</em>.</td>
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<td>W 1x+ 1x YC*</td>
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</tr>
<tr>
<td>&lt;GS7&gt;</td>
<td>Skybridge Penalties:  a) <strong>Grasp</strong> Skybridge.  b) <strong>Move</strong> from one Zone to the other via opposing Alliance’s Skybridge.  c) <strong>Blocking</strong> via Neutral Skybridge.</td>
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<tr>
<td></td>
<td>a) <em>Major Penalty</em>  b) <em>Major Penalty</em>  c) <em>Per &lt;G18&gt;</em></td>
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<tr>
<td>&lt;GS8&gt;</td>
<td>Controlling opposing Alliance’s Foundation when In Building Site or End Game.</td>
<td><em>Major Penalty</em> is assessed plus an additional <em>Minor Penalty</em> per 5 seconds in violation. May escalate to <em>Yellow Card</em>.</td>
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<td>1x+ 1x YC*</td>
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<tr>
<td>&lt;GS9&gt;</td>
<td>Descoring opposing Alliance’s Stones/Capstones when Foundation In Building Site.</td>
<td><em>Double Major Penalty</em> per Stone. <em>Major Penalty</em> per Capstone.</td>
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<td>2x 1x</td>
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<tr>
<td>&lt;GS10&gt;</td>
<td>Foundation Movement not Completely In Building Zone.</td>
<td><em>Minor Penalty</em> per 5 seconds in Violation.</td>
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<td>W 1x 1x 1x</td>
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<tr>
<td>&lt;GS12&gt;</td>
<td>Touching Robots/Driver Station after Quarry randomization</td>
<td><em>Minor Penalty</em>, Robot not eligible for Stone Delivery Score in Autonomous</td>
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<td></td>
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</tbody>
</table>

**Column Key**

- **W**: Warning  
  - 1x: *Penalty* at normal (single) cost  
- **D**: Robot Disabled  
  - 2x: *Penalty* at double cost  
- **D**: Robot optionally Disabled  
  - Pts: Points that would have counted without violation  
- **YC**: Yellow Card issued  
  - RC*: *Red Card* optionally issued  
- **YC**: Yellow Card optionally issued
Appendix A – Resources

**Game Forum Q&A**
http://ftctforum.usfirst.org/forum.php
Anyone may view questions and answers within the FIRST® Tech Challenge Game Q&A forum without a password. To submit a new question, you must have a unique Q&A System User Name and Password for your team.

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FIRST Tech Challenge Blog – Weekly articles for the FIRST Tech Challenge community, including Outstanding Volunteer Recognition!
FIRST Tech Challenge Team Email Blasts – Contains the most recent FIRST Tech Challenge news for Teams.

**Feedback**
We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!
Appendix B – Field Details

Note: The dimensions in the following diagrams are nominal dimensions, actual dimensions will vary slightly for each Field. Robots should be designed to accommodate this variability.

**Figure B-1 Skybridge**

**Figure B-2 Building Site**
Figure B-3 *Foundation* Starting Position

Figure B-4 *Skybridge* Tape

Figure B-5 *Depot*
Figure B-6 Quarry Setup

Figure B-7 Location of Navigation Target (as seen from Outside the Field)

The exact locations of the Navigation Target are shown in the Field Setup Guide.

Figure B-8 Navigation Target (as seen from Inside the Field)
Figure B-9 *Skybridge* Images (as seen from Inside the Field)

Figure B-10 *Skystone* Image
Appendix C – Scoring Elements

Figure C-1 Stone

Figure C-2 Skystone
Figure C-3 Foundation
Appendix D – Quarry Randomization

Skystones

Pattern A

Dice Roll

or

Pattern B

Pattern C

Skystones

or

or

or
Appendix E – Scoring Examples

Example E-1

Number of *Scored Stones* = 5 points

Tallest *Skyscraper Level* = 1
   *Skyscraper Bonus* = 2 points

*Capstone A Level* = 0
   *Capping Bonus* = 5 points
   *Level Bonus* = 0 points

*Capstone B Level* = *Not Placed*
   *Capping Bonus* = 0 points
   *Level Bonus* = 0 points

*Total Score* = 12 points

Example E-2

Number of *Scored Stones* = 8 points

Tallest *Skyscraper Level* = 2
   *Skyscraper Bonus* = 4 points

*Capstone A Level* = 2
   *Capping Bonus* = 5 points
   *Level Bonus* = 2 points

*Capstone B Level* = 0
   *Capping Bonus* = 5 points
   *Level Bonus* = 0 points

*Total Score* = 24 points
Example E-3

Number of Scored Stones = 21 points

Tallest Skyscraper Level = 7
  Skyscraper Bonus = 14 points

Capstone A Level = 6
  Capping Bonus = 5 points
  Level Bonus = 6 points

Capstone B Level = 6
  Capping Bonus = 5 points
  Level Bonus = 6 points

Total Score = 57 points

Example E-4

Number of Scored Stones = 16 points

Tallest Skyscraper Level = 10
  Skyscraper Bonus = 20 points

Capstone A Level = 10
  Capping Bonus = 5 points
  Level Bonus = 10 points

Capstone B Level = 4
  Capping Bonus = 5 points
  Level Bonus = 4 points

Total Score = 60 points
Example E-5

Number of Scored Stones = 7 points

Tallest Skyscraper Level = 1
   Skyscraper Bonus = 2 points

Capstone A Level = 0*
   Capping Bonus = 5 points
   Level Bonus = 0 points

Capstone B Level = Not Placed
   Capping Bonus = 0 points
   Level Bonus = 0 points

Total Score = 14 points

* Because Capstone A is not supported by a legal Skyscraper, it does not earn a Level Bonus

Example E-6

Number of Scored Stones = 24 points*

Tallest Skyscraper Level = 5**
   Skyscraper Bonus = 10 points

Capstone A Level = 0***
   Capping Bonus = 5 points
   Level Bonus = 0 points

Capstone B Level = 5
   Capping Bonus = 5 points
   Level Bonus = 5 points

Total Score = 49 points

* A Red Robot is touching one Stone, so that Stone does not count.
** The Level 7 and Level 6 Skyscraper does not count because a Red Robot is in contact with a Stone in the Skyscraper.
*** Capstone A is not supported by a legal Skyscraper.
Example E-7 What is a Skyscraper?

Skyscraper A consists of 5 Stones

Skyscraper B consists of 25 Stones

Skyscraper C consists of 10 Stones

Even though Skyscraper B has what appears to be two separate peaks, both peaks share Stones so it counts as one Skyscraper.

Because Skyscraper C does not share any Stones with Skyscraper B, it is considered a separate Skyscraper. Therefore a Robot touching Skyscraper B does not affect the legality of Skyscraper C.