Ai Autonomous Driving	Division	Team	Building
	Junior/Senior	1~3 Member Max 1 Robot	On-Site

1. Game Description

AI autonomous driving is category driving between two lanes without leaving the lane using 4-wheel driving robot. It must run stable without leaving the lane using camera. Technical ability such as image processing and programming, and ability to solve while adjusting to the site situation will be considered.

2. Robot

2-1. Types of robot 4-wheel drive travelling robot

2-2. Construction of robot (on-site production)

All machine part except robot controller must be produced (soldering available) on site. Size must follow the rule and available to measure by measuring machine.

2-2-1. Standard of robot

2-2-1-1. Size of robot

1) **Size:** 18 cm x 20 cm x 25 cm or less (width) x length x height) <Revised 2023.11.1>

2) **Wheeltrack** The distance of tread of each Wheeltrack of the robot shall be at least 6 cm.

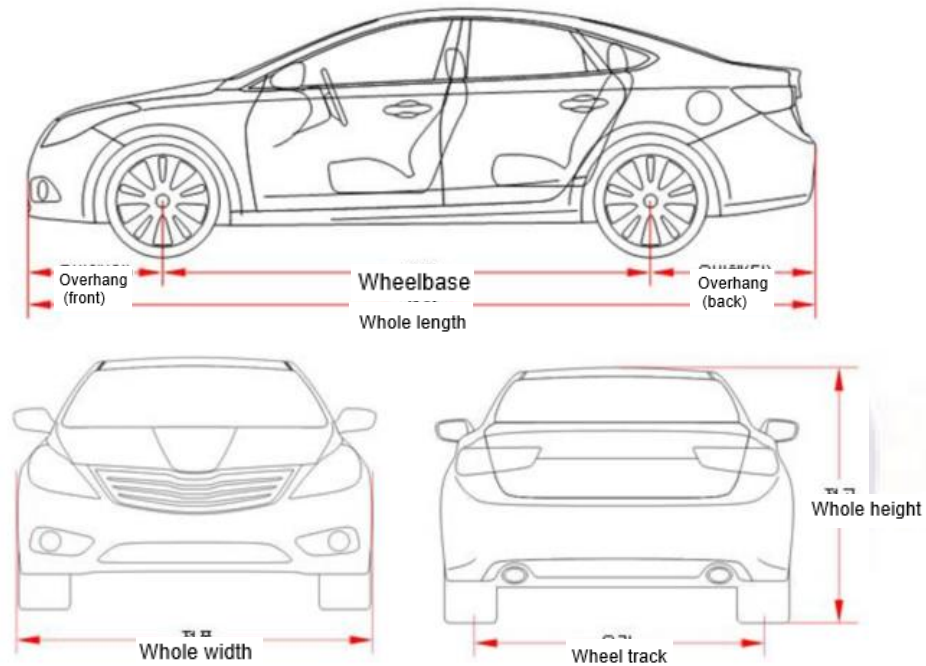3) **Wheelbase**: The distance of axle of each Wheelbase of the robot shall be at least 5 cm.

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Figure 1<Definition of each parts>

2-2-1-2. Size measurement of robot

1) Self-measurement: Participant are allowed to measure their robot when producing or practicing .

2) Official measurement: Judge will measure the size of the robot before the game starts.

3) Way of measuring: Size must be measured with the robot turned on, using the measuring machine. Participant cannot object to the judgement.

4) Modification time: If over-sized, the participant is allowed to modify for 1 minute on the recording place of the playfield. If the participant can't modify within the limited time, they will be disqualified for the trial.

5) If the sizes changes when going through the timer with the one measured before starting, the participant may be disqualified.

2-2-2. Sensor of robot No Restriction <Revised 2023.12.1>

2-2-3. Motor of robot

1) Drive: 1 servo motor, 1 DC motor
2) Sensor: 1 servo motor

2-2-4. Controller of robot Controller of Robot The controller of robot has no limitation. (Smartphones are not recognized as controllers.)

*Arbitrary usage of the regulation may be held liable for copyright infringement.

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2-2-5. Power of robot

2-2-5-1. Composition of power Autonomous movable independent power must be used, and combustion engine is not allowed to use.

2-2-5-2. Capacity of power No limitations on current and voltage level.

2-2-6. Drive of robot Recognize the operation of the robot using only the method learned in the stadium on the same day <Revised 2023.10.30>

2-3. Programming and controlling Rbot must be able to drive autonomously through the program, no manipulation shall be made from outside except when departing.

2-3-1. WI-Fi Programming must be done using Wi-Fi provided by organizers.

2-3-2. All programs other than the data required for programming should be removed (deleted) from the notebook, and if the act of cheating on code production on the site by writing code on the installed memo pad is detected, the participant will be disqualified for violation of regulations. If found remaining on the laptop after the end of the competition, it will be disqualified and the award will be nullified. <Revised 2023.10.30>

2-4. Disconnection between motor horn and wheel Wheel and tire doesn't need to be disconnected, and they are not supposed to be connected in advance.

3. Competition site

3-1. Official competition site Playfield approved by International Robot Olympiad Committee.

3-2. Size and composition The space within 3M X 3M consists of roads with curved surfaces and straight lines. <Revised 2023.11.1>

3-2-1. Allowable range of error in the stadium The slope under 2º (error ±10%) and a gap or bump under 3mm (error ±10%) is allowable.

3-2-2. Outer wall of field Outer wall of the playfield for camera filtering of the robot is one-colored, and is 30cm (error ±10%).

3-3. Playfield Covered with a matte coated pet paper, and there may be an advertisement or a logo of the host.

3-3-1. Mission map It uses a printed mission map and is fixed to the stadium with sheet paper and tape. In addition, the distance score is marked on the grid based on the starting point for score recording.

3-3-2: Line 2cm width (error ±10%) white line

3-3-3. Formation of lane Lane is constituted of two parallel lines, and the width of the lanes is 160mm(error ±10%). The lane may be curved depending on the mission. <revised 2023.11.23>

3-3-4. Composition of lane Lane is composed in straight and curved line

3-3-5. Installation of the Measuring instrument
In order to measure the time record, a measuring instrument is installed at the starting point and the arrival point, the location and direction may vary depending on the mission, and a separate structure connected to the stadium may be used.

3-4. Obstacles Each mission has the following mission obstacles to help with the mission.

3-4-1. Blocking bar Each mission has the following mission obstacles to help with the mission.

3-4-1-1. With the bar block bar closed, it opens automatically 5 seconds after robot recognition.

3.4.1.1. The length of the block bar is 20 cm (±2 cm).

3.4.1.2. Blocking bars and sensors are installed on the right or left side of the lane.
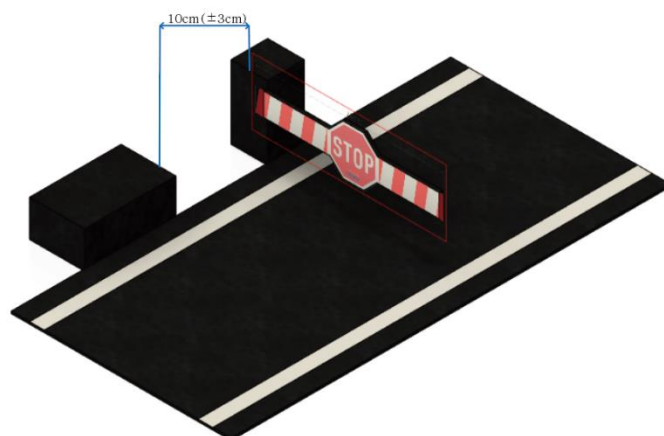
3.4.2. Traffic light when the robot recognizes the traffic light, which was red, turns green after 5 seconds.

**3.4.2.1.** The traffic light uses an LED lamp capable of expressing RGB.

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3.4.2.2. The signal display of the traffic light shall be one lamp, and one lamp shall change the color and display the signal.

3.4.2.3. The traffic light initially set to red turns green after robot recognition.

3.4.2.4. The position of the traffic light and the sensor are installed to the right or **left.**

3.4.2.5. The size of the traffic light lamp is 3 cm (±0.5 cm) X3 cm (±0.5 cm) (width X length) including the rim. (The rim of the traffic light lamp is black.)
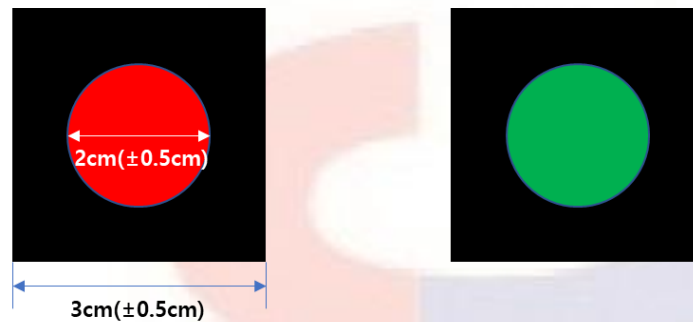
3.4.2.6. The lamp at the traffic light shall be installed such that the lower part is 5 cm (±2 cm) above the ground.

<Example of traffic light installation>
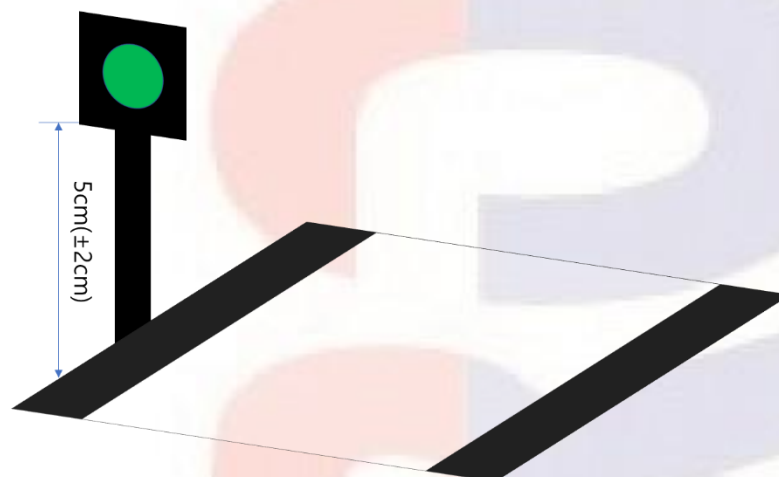
3.4.3. Human mission When the human model is found, the robot stops unconditionally, and when the human model is removed, the robot proceeds to drive again. <Newly Established 2023.11.30>

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4.5cm(±1cm)

1.5cm(±1cm)

3.4.4. The Speed Sign speed of '30' and '70' shall be displayed on the speed indication lane, and the driving speed of the robot shall be automatically slowed or increased according to the speed indicated. <Newly Established 2023.11.30>

1cm(±0.5cm)

9cm(±1cm)
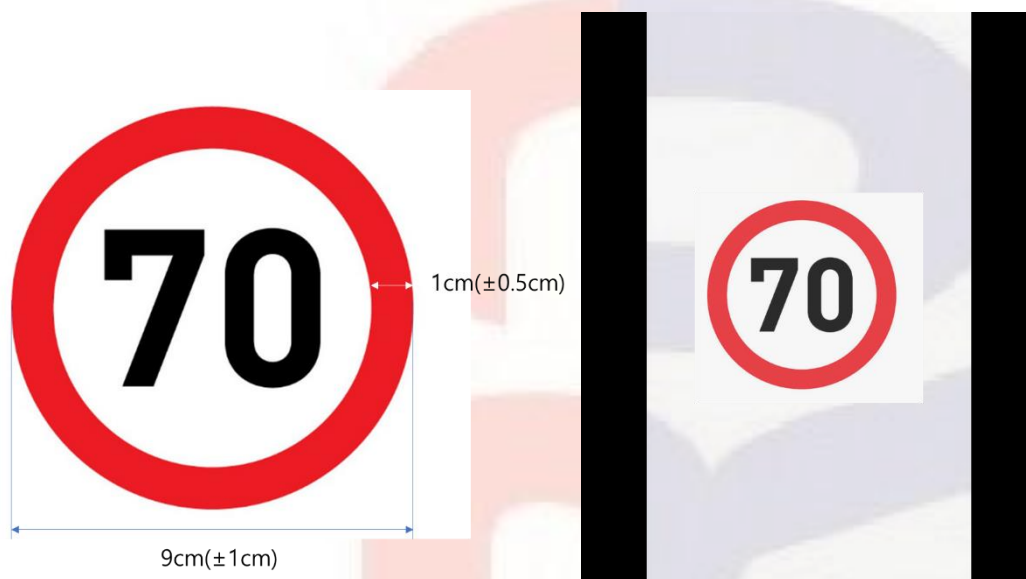
4. Competition progress

4-1. Way of game process Game is processed by record, and the chance is given twice. Rectifying time will be given between each chances.

4-2. Robot production and practicing time At least 2 hours will be given for producing robot and practicing, and will be noticed on the day.

4-3. Assignment of playfield Depends on number of participants and level of difficulty.

4-4. Production and practicing Participant can practice on the playfield until production and practicing time noticed, but cannot before playfield assignment.

4-5. Production and end of practicing When time for production and practicing finishes, the participant must stop the robot and go back to their seat following staff and referee's instruction.

4-6. 1ˢᵗ trial 1ˢᵗ trial will start right after the production and practicing time (or after lunch).

4-6-1. Preparing competition All participants must bring their robots and wait in line following instruction of staff and referee.

4-6-2. Stand by after competition All participants should not go back to their seat, but must wait in line after their trial until all participant finishes their trial.

4-7. Modification Time for modification will be given to all participant after 1ˢᵗ trial for robot modification and practicing. Modification time will be noticed on the day.

4-8. 2ⁿᵈ trial 2ⁿᵈ trial will be held right after the modification.

4-8-1. Preparing competition All participants must bring their robots and wait in line following instruction of staff and referee.

4-8-2. Stand by All participant must go back to their seat after their trial.

5. Match

5-1. Performing mission The route of the mission execution is designated, but the mission execution is randomly arranged.

5-2. Acquiring score Score will be acquired by the distance the robot stopped. If course finishes, time record will be acquired.

5-2-1 Deduction

5.2.1.1. If one or more wheels of the robot are completely off the line, one deduction will be given. (A deduction should be made when one or more wheels are completely off the outside of the line, and if it is slightly extended, it is recognized as normal operation.)
5.2.1.2. If the robot is not aware of the speed sign and fails to slow down or increase the speed, 3 points will be deducted respectively. <Revised 2023.11.30>

5-2-2 NO score driving A score in a section obtained by driving one or more wheels of the driving robot completely off the line is not recognized. < Revised 2023.11.30>

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5-2-3　Obstacle Mission

5.2.3.1. There is a stop section in front of the traffic light, and the range of the stop section is presented differently depending on the mission. The robot must stop within the stop section, and if it stops outside the stop section suggested by the mission, the sensor does not work and the color of the traffic light does not change.

5.2.3.2. The stopping distance between the blocking bar robot and the blocking bar is presented differently depending on the mission. If it is more than the stopping distance suggested by the mission, the sensor will not work and the blocking bar will not go up.

5.2.3.3. The human doll shall be installed at any location where the judge travels in an unexpected situation, and the stopping distance from the human doll shall not exceed 10 cm. If it stops or hits more than 10cm, the game will be terminated immediately.

5.2.3.4. If the obstacle mission is not performed, the game will be terminated immediately and the record before the declaration of termination will be recognized.
< Revised 2023.11.30>

5.2.4. Additional points

5.2.3.1. The implementation of various functions such as headlights, brake lights, and hazard notifications using LEDs and buzzers is presented differently depending on the mission, and additional points are given when performing the mission. Additional points are presented differently depending on the mission.
< Revised 2023.11.30>

5-3. Start Run the robot and place it behind the block bar at the starting point. At this time, the robot must be in a driving state and must be stationary by recognizing the blocking bar at the starting point. When the referee presses the start button and the block bar rises, the robot must start, and the timer is activated at the same time as the button is pressed. < Revised 2023.11.30>

5-3-1. Miss Start In this competition, if the robot does not become operable within 20 counts, it will be declared non-start. In addition, if the departure block bar is not started within 15 counts after the departure block bar is raised, the non-start will be declared and an opportunity to restart will be given. There are two re-starts given for non-starts. < Revised 2023.11.30>

5-3-2. A false start If the robot is activated before the referee presses the start button and hits the block bar or leaves the stadium, a false start will be declared and one restart will be given.

5-3-3. Restart Two restarts are given for non-start and one restart for false start. However, a maximum of two re-start opportunities are given. (No number of restart is given for non-start or false start at the restart opportunity. e.g.) No chance to restart if not departing after a false

departure. If you do not start after a non-start, you have one chance to start again. One chance to restart if there is a false start after a non-start. No chance to restart if not after the second non-departure.)

5-4. Arrival If arrival robot passes through the instrument sensor installed at the end point and the time measurement stops, it is assumed that it has arrived.

5-4-1. Destination mission The robot arriving at **the destination** mission arrival point must stay at the arrival point of the judge at least 3 counts to be recognized as a successful destination mission.
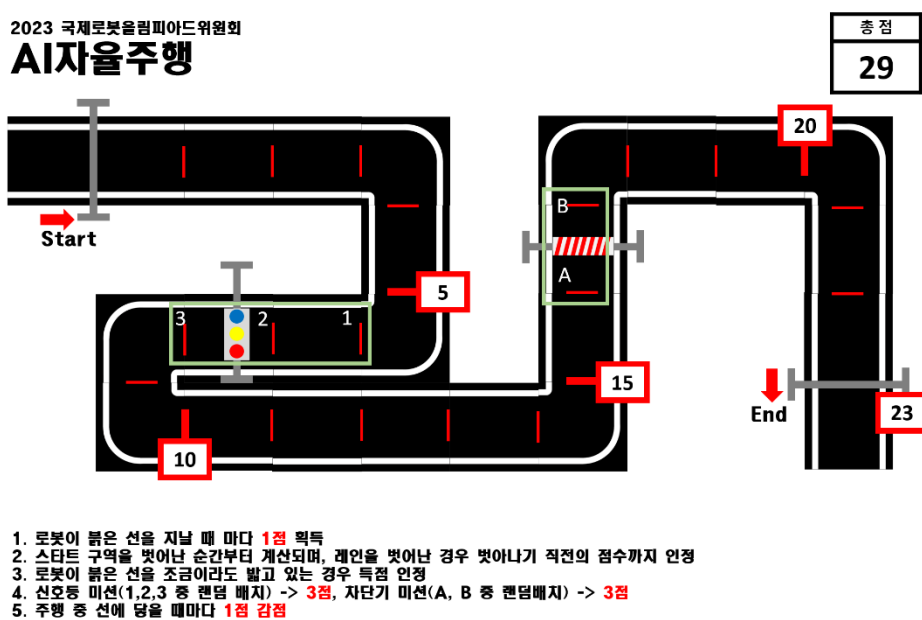
5-5. Time limit Total game time is up to 3 minutes. < Revised 2023.11.30>

5-6. The course that the mission robot will drive will be released in the form of a mission paper at the site before the start of the game.

**Example of a mission** < Revised 2023.12.12>

EX Example Mission

2023 국제로봇올림피아드위원회
AI자율주행

총점 **29**

1. 로봇이 붉은 선을 지날 때 마다 **1점** 획득
2. 스타트 구역을 벗어난 순간부터 계산되며, 레인을 벗어난 경우 벗어나기 직전의 점수까지 인정
3. 로봇이 붉은 선을 조금이라도 밟고 있는 경우 득점 인정
4. 신호등 미션(1,2,3 중 랜덤 배치) -> **3점**, 자단기 미션(A, B 중 랜덤배치) -> **3점**
5. 주행 중 선에 닿을 때마다 **1점** 감점

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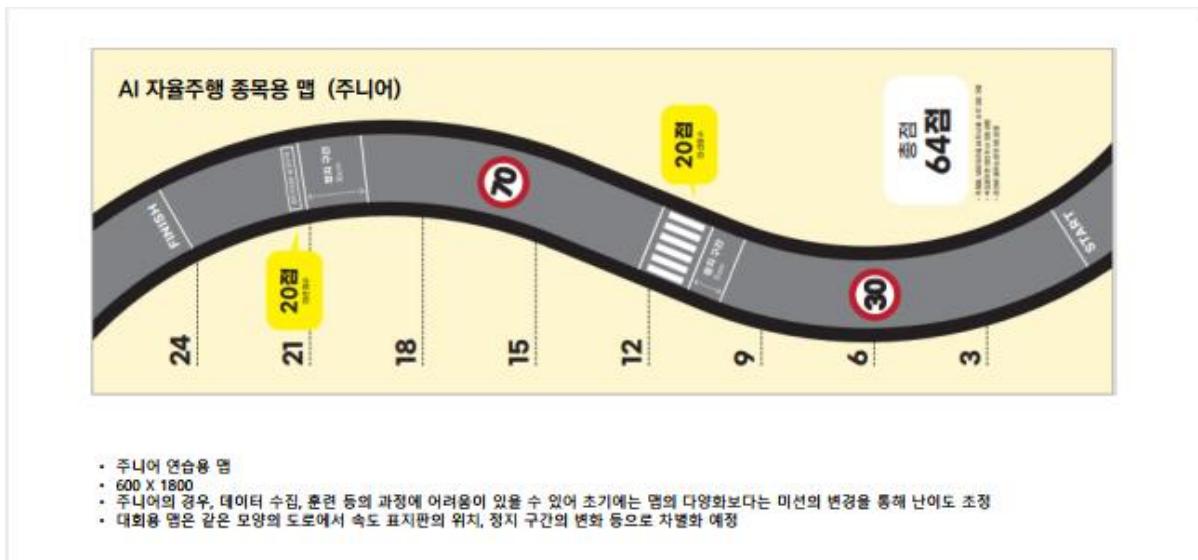
5-7. Finish of competition

5-7-1. Robot arrival If robot goes through the finishing line before the limited time an as the timer stops, the competition finishes, and time the robot went through the line and mission points will be accepted as a record.

5-7-2. Time over If robot doesn't go through the finishing line within the limited time, the points when time limit finishes will be accepted as a record.

5-7-3. Robot stop When robot doesn't move while competition, referee gives 10 count. If the robot doesn't move while counting, robot stop will be declared, and the points when robot stops will be accepted as the record.

5-7-4. TKO (Technical Knock Out) When moving ordinarily is impossible, referee may declare TKO conforming to robot stop without 10 counts. (i.e. when moving the same places repetitively, when blocked by a structure or obstacle and not moving, when moving out of the playfield (falling from the playfield), etc.)

5-7-5. Lane out When the robot doesn't exist between the lines constituting the lane. If robot totally gets out of the lane, the game finishes, and the score till the announcement will be accepted.

5-8. Game over due to disqualification
When violating game rules or interrupting game, game will finish as disqualification, and the record of the trial will not be accepted.

5-8-1. Robot touch If the participant touches the robot without an acceptance of referee or staff, robot touch may be declared, and the trial will be disqualified.

5-8-2. Robot modification while competition Adding, removing, exchanging or modifying component of the robot during the competition is not allowed, and if holding extra components, tools, or batteries while waiting for purpose of modifying robot, the trial will be disqualified.

5-8-3. Tuning sensor When trying to tune sensor before competition, the trial will be disqualified.

5-8-4. Defaulting assigned playfield When playing or practicing at other's playfield except the assigned field, the participant will be disqualified.

5-8-5. False start When starting false for twice at the trial, the participant will be disqualified.

5-8-6. Not started If not starting for three times at the trial, the participant will be disqualified.

5-8-7. When using programs other than programming
Disqualification and exit shall be made when using a program other than during practice or programming during the competition

5-9. Rematch When accident such as blackout or trouble in timer happens, rematch may occur as a decision of referee.

5-10. Decision of referee Referee has authorization to control all situations and participants at all times during the competition. Judgement of the competition result is referee's own authorization and referee has authorization for the final judgement.

6. Competition record

6-1. Recording items Scores for each driving section, deductions for driving, and additional points for the use of sensors

6-2. Points per course Points are counted after referee's finishing declaration at the point where the robot stops. The highest point is accepted among spots that the front wheel touches.

6-3. Time record Time counted on the timer at the starting point and finishing point will be acknowledged as the time record. (Robot stop, robot falling, TKO, lane out will not be acknowledged as time record.)

6-4. Final record Better record among 1st trial and 2nd trial will be considered as the final record.

6-5. Priority of record Group will be divided by number of succeeded target mission, and the ranking will be decided by comparing driving record, and when arrived at the finishing point, the one who succeeded the finishing mission takes the priority.

**Mission Performance Score > Course Score > Number of Deductions > Presence of Time Record
> Success or failure of stop line mission > Time record comparison**

6-5-1. Priority on trial If tied at the same trial, record of another trial will be compared.

6-5-2. Priority when tied Better score among 1st or 2nd trial will be acknowledged, but when tied, the participant with better score on the 1st trial takes the priority.