

**San Jose State University**  
**Computer Engineering Department**

**CMPE 187 Spring 2024**

**AI TEST MODELING REPORT**

**Project - AI Chatbots**

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# 1. AI Function Test Requirement Analysis

## 1.1 AI Function Test Requirement

In this section, the requirements for testing the AI functions of our applications are introduced. The features in question that each of our applications will be testing falls under the Natural Language Processing (NLP) classification. The AI feature of the applications is to receive a question in the form of text through an input text field. Based on the question, we plan to assess how well the chatbot was able to understand the inputted question, which can either consist of no errors, have some typos, or have grammar issues. Based on the understanding of the inputted question, we plan to evaluate the text generation feature of the chatbot, through the length of the response and the coherence behind the logic. Similarly, we plan to assess the knowledgeable base of the chatbots based on the content of the response provided to the question. Digging further into the NLP feature, we want to gauge how well the chatbot can remember information from the conversation. The last feature that we would like to measure would be how well the chatbot can talk about Formula 1 and identify whether the information is relevant or irrelevant to the topic. Based on the response of the chatbot, we can evaluate how well the chatbots function. The chatbots in question are listed below:

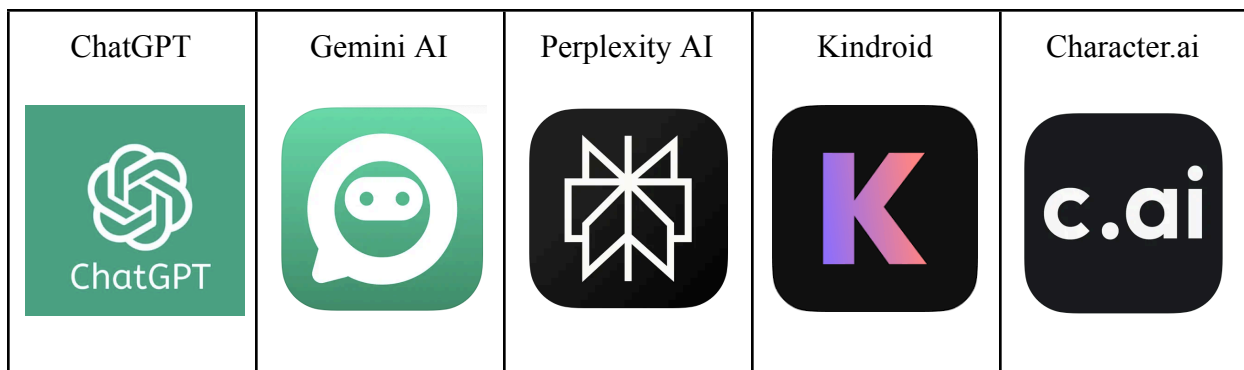


Figure 1.1 Chatbots to be Tested

## 1.2 AI Function Test Requirement Modeling

We will collect many different questions to test whether the AI chatbot NLP feature can provide the correct response or not in the following conditions: f1 related questions, non-f1 related questions, complete and incomplete questions, and questions with grammatical errors, typos, or no errors. The result of these tests would fall into two different conditions: correct or incorrect. However, we want to look deeper into the response of the chatbot and see whether the information that they provide within their response is accurate or not. For certain responses, there are multiple individuals who share the same statistic, such as Michael Schumacher and Lewis Hamilton both having 7 world championship titles. Certain AI chatbots may respond by only saying that Michael Schumacher OR Lewis Hamilton has the most titles, which is not incorrect but fails to state both drivers, as a result we would declare this result as correct but fails to provide strong reporting evidence. Below is the AI Function Classification Tree:

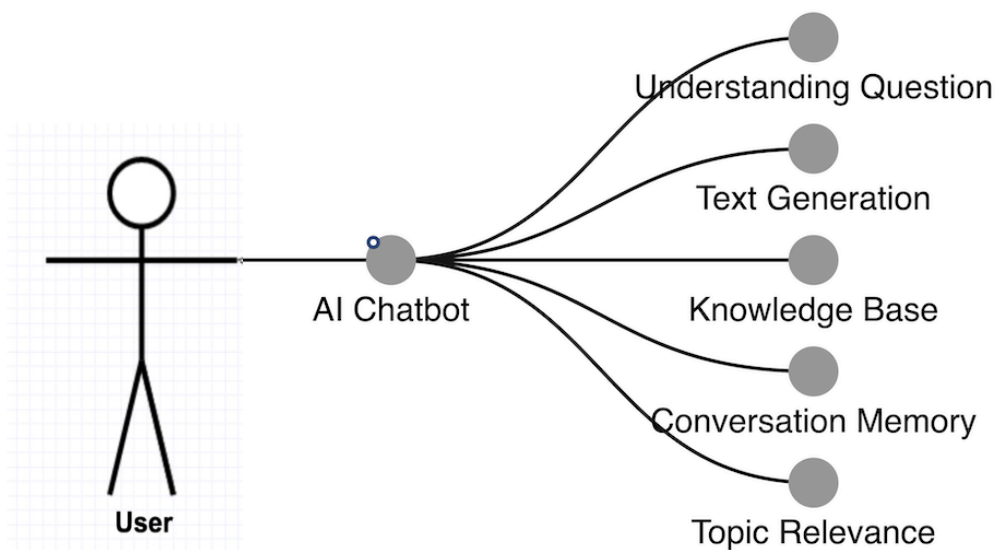


Figure 1.2 AI Function Feature

## 2. AI Test Modeling for Selected AI Features

### 2.1 Context Modeling for AI Features

While creating the test model for the chatbots, we generated a context classification spanning tree which contains four major nodes (Quality, Relevance, Completeness, Statement, and Demographic) and fourteen detailed test cases that will represent the types of the questions that we input into the chatbots.

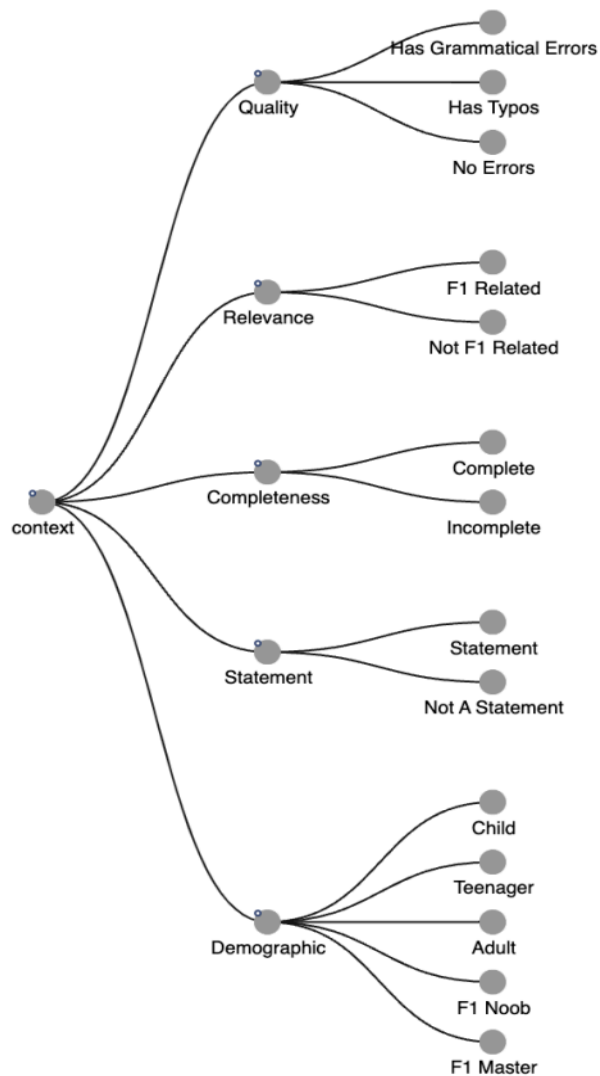


Figure 2.1 Context Classification Spanning Tree

## 2.2 AI-Powered Function Input Classifications

When creating the Input Classification Spanning Tree, we had 5 major subtopics within the realm of Formula 1 (Race History, Constructors, Drivers, Cars & Technology, and Rules). With those 5 major test cases, which when expanded are then able to generate 26 detailed test cases that have allowed us to generate the Input Classification Spanning Tree.

The Input Classification Spanning Tree was broken down into 5 separate trees that all represent the different topics that allow us to generate the test cases for the input model. The first tree belongs to the Race History subtopic, which yields 5 test cases: Weather Affected Races, Race Track Locations, Unforgettable Moments, Controversial Wins, and Circuit Characteristics.



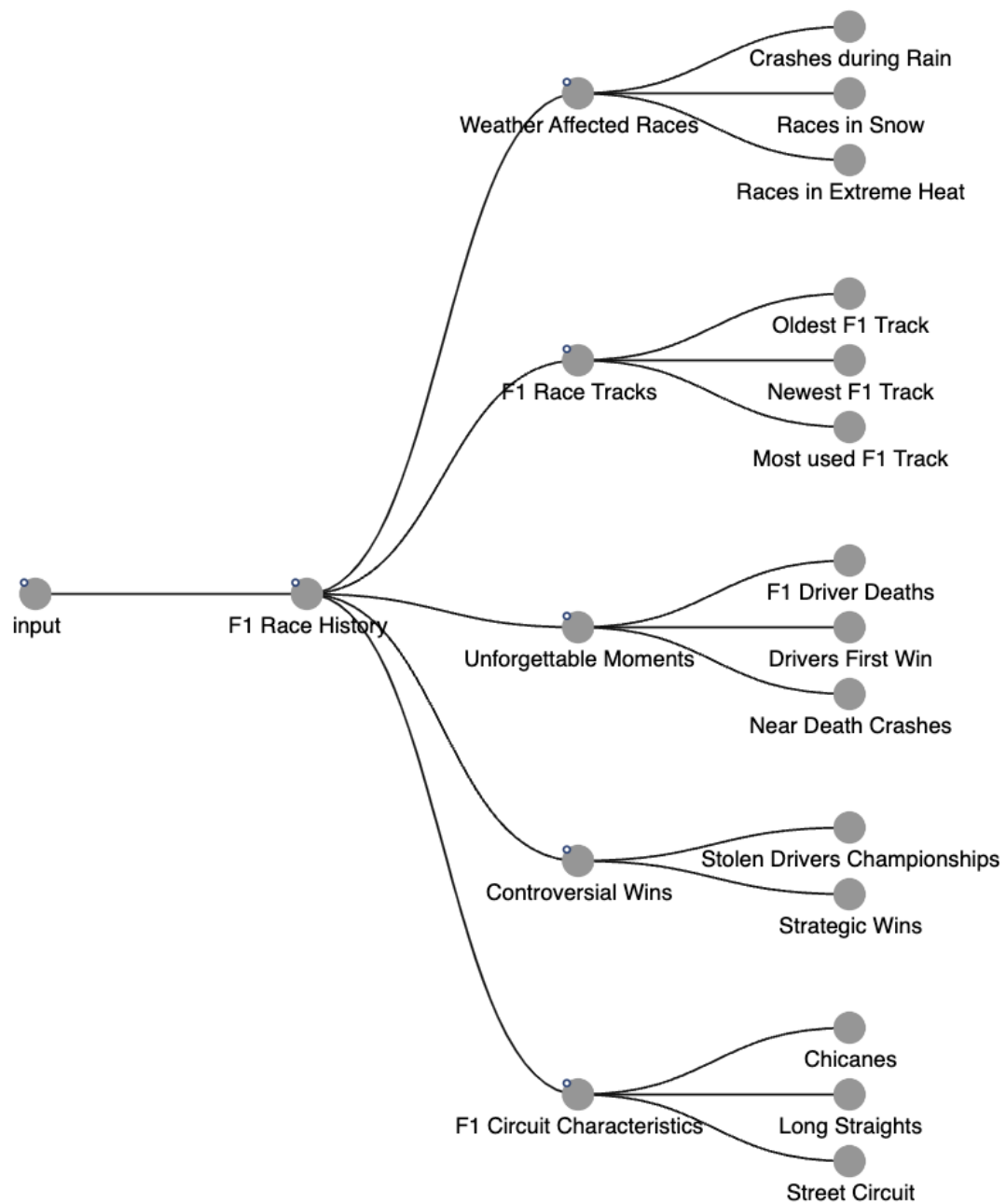


Figure 2.2 Input Classification Spanning Tree - Subtopic: Race History

The constructors input classification tree consists of 3 different subtopics (Constructors Championships, Iconic Cars, and Leadership) which will allow us to generate new test cases.

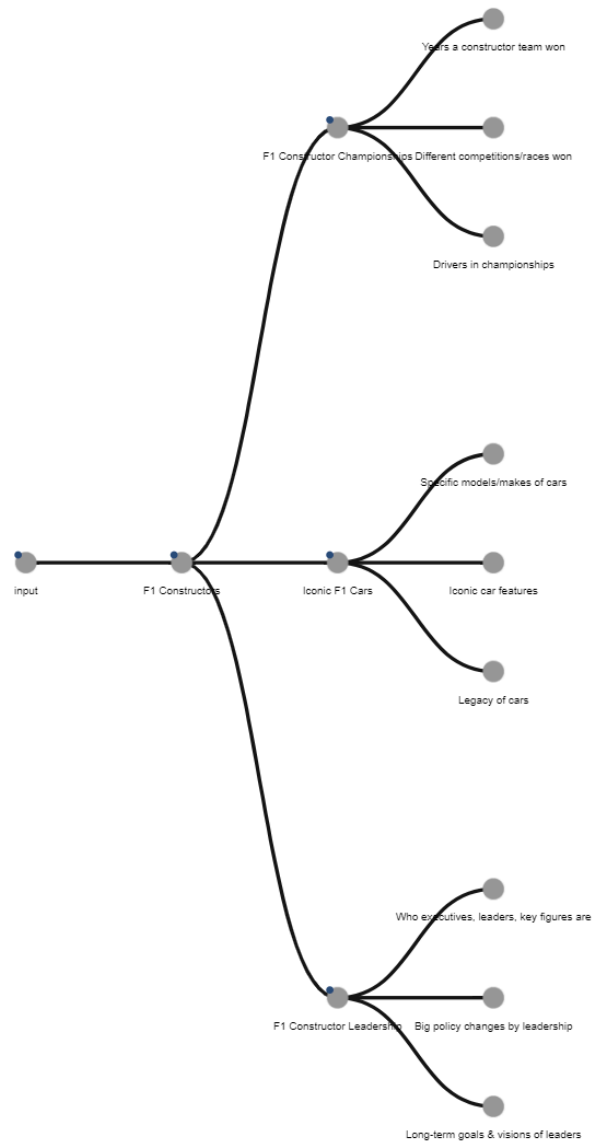


Figure 2.3 Input Classification Spanning Tree - Subtopic: Constructors

The drivers input classification tree consists of 5 different subtopics (World Championships, Race Wins, Pole Positions, Podiums, and Rivalries) which will allow us to generate new test cases.

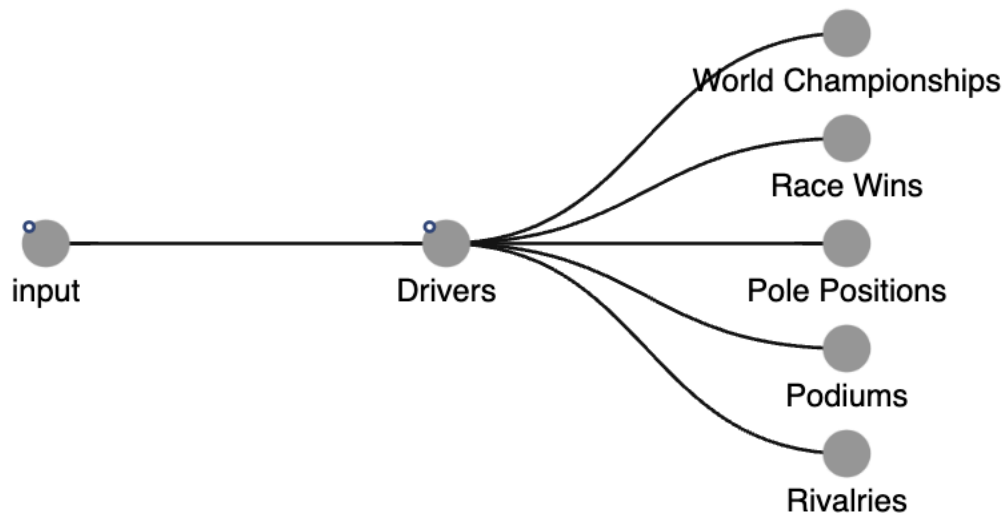


Figure 2.4 Input Classification Spanning Tree - Subtopic: Drivers

The cars and technology input classification tree consists of 5 different subtopics (Tires, Power Units, Safety Innovations, Hybrid & Electric Tech, and Aerodynamics) which will allow us to generate new test cases.

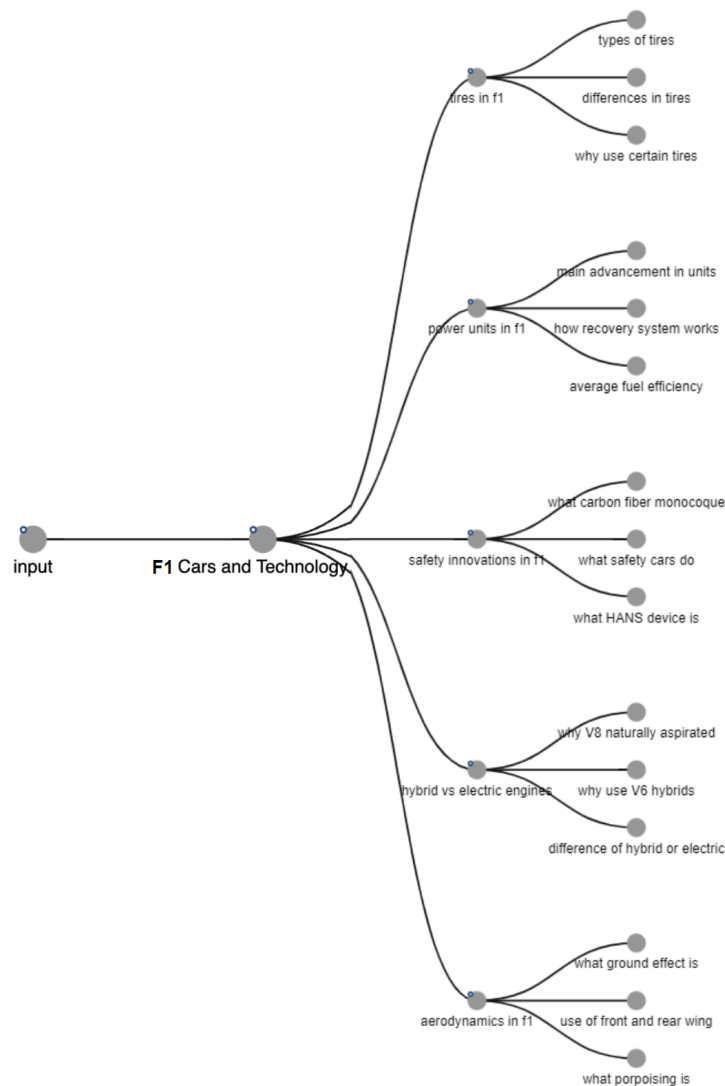


Figure 2.5 Input Classification Spanning Tree - Subtopic: Cars & Technology

The cars and technology input classification tree consists of 2 larger topics (Sporting Regulations and Technical Regulations) that diverge into 8 different subtopics (Chassis, Engine, Tires, Refueling, Parc Ferme, Scoring System, Team Spending, and Penalties and Flags) which will allow us to generate new test cases.

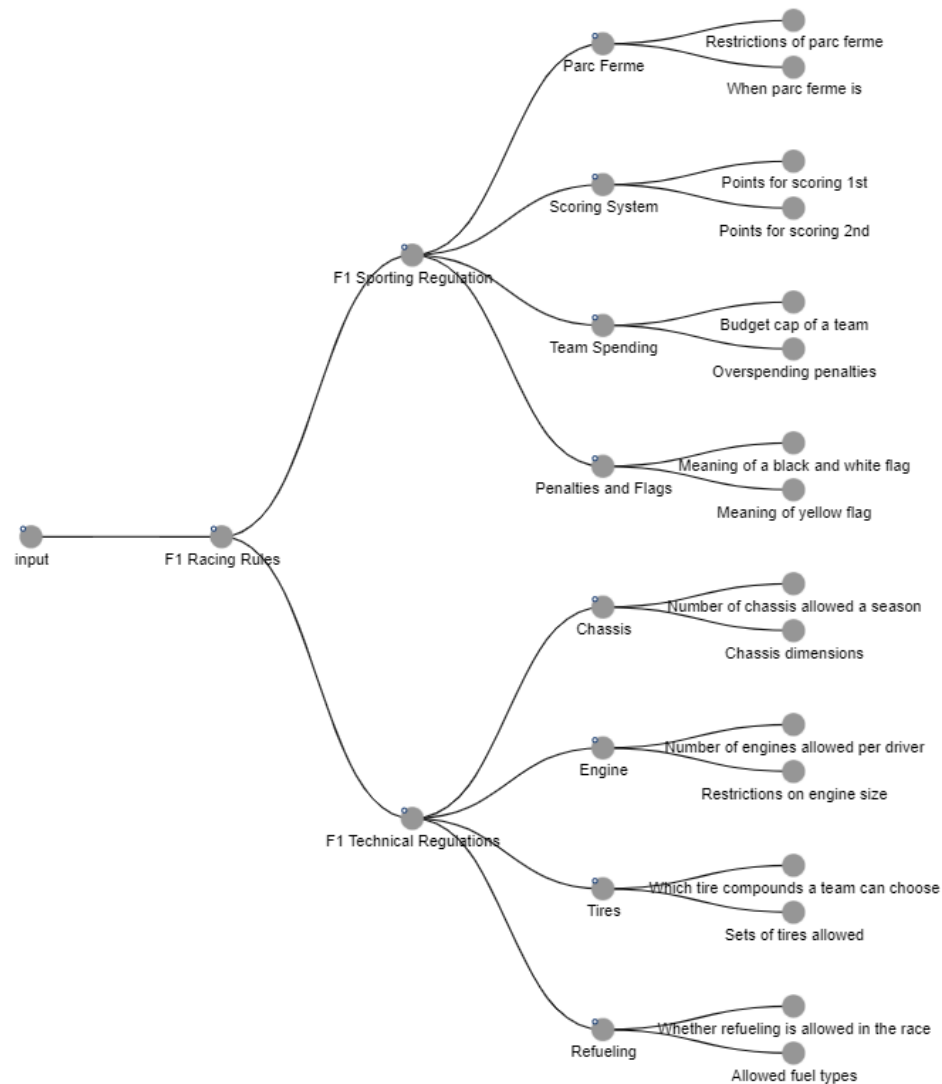


Figure 2.6 Input Classification Spanning Tree - Subtopic: Rules

## 2.3 AI-Powered Function Output Classifications

Based on the two major output results of the 5 chatbot applications that we tested, we listed the two possible outputs along with if the output was accompanied by accurate or inaccurate evidence. Using those 2 outcome results, we then created the Output Classification Spanning Tree.

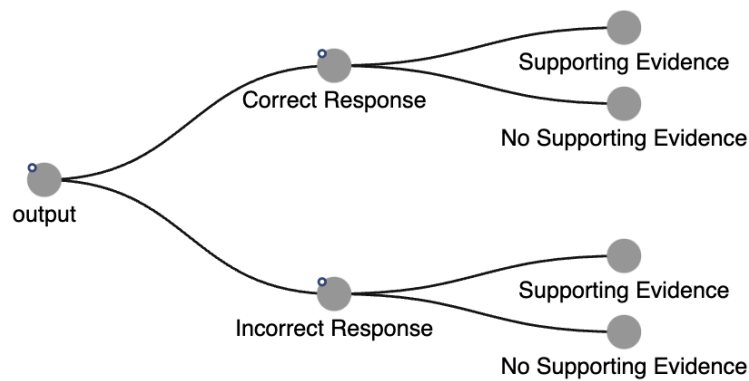


Figure 2.7 Output Classification Spanning Tree

## 2.4 AI-Powered Function Action/Event Classifications

During the testing procedure, the chatbots will respond to the questions when they receive a question in the form of user input through a text field. Then, using the NLP feature, the chatbot will then generate a response for the question and display it to the user using the text generation feature. Below is a depiction of the events/actions of the chatbot and user interaction in the form of a spanning tree:

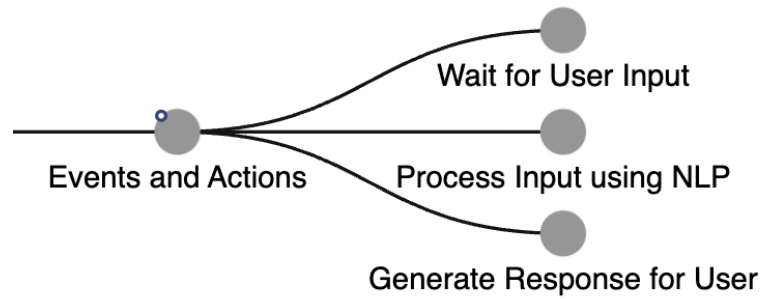


Figure 2.8 Events/Actions Classification Spanning Tree

## 2.5 AI-Powered Function Classification Decision Tables

Using the AI Testing Tool, we were able to take the Context Classification Spanning Tree, Input Classification Spanning Tree to generate a 3D Classification Decision Table. Based on the different combinations of input and context test cases will result in different output cases.



Figure 2.9 3D Table

### 2.5.1 Context Spinning Tree

ID	Quality	Relevance	Completeness	Statement	Demographic
C1	Grammatical Error	F1 Related	Complete	Not a statement	F1 Master
C2	Typos	F1 Related	Complete	Not a statement	F1 Noob
C3	No Error	F1 Related	Complete	Not a statement	Adult
C4	No Error	Not F1 Related	Complete	Not a statement	Child
C5	No Error	F1 Related	Incomplete	Not a statement	Teenager
C6	No Error	F1 Related	Complete	Not a	F1 Noob



				statement	
C7	No Error	F1 Related	Complete	Statement	F1 Master

## 2.5.2 Input Spinning Tree

ID	Main topic	Subtopic
I1.1	Race history	Weather affected races
I1.2	Race history	Race track locations
I1.3	Race history	Unforgettable moments
I1.4	Race history	Controversial wins
I1.5	Race history	Circuit characteristics
I2.1	Constructors	Constructors championships
I2.2	Constructors	Iconic cars
I2.3	Constructors	Leaderships
I3.1	Drivers	World championships
I3.2	Drivers	Race wins
I3.3	Drivers	Pole positions
I3.4	Drivers	Podiums
I3.5	Drivers	Rivalries
I4.1	Cars and technology	Tires
I4.2	Cars and technology	Power units
I4.3	Cars and technology	Safety Innovators
I4.4	Cars and technology	Hybrid and electric tech
I4.5	Cars and technology	Aerodynamics

I5.1.1	Technical regulations	Chassis
I5.1.2	Technical regulations	Engine
I5.1.3	Technical regulations	Tires
I5.1.4	Technical regulations	Refueling
I5.2.1	Sporting regulations	Parc ferme
I5.2.2	Sporting regulations	Scoring system
I5.2.3	Sporting regulations	Team spending
I5.2.4	Sporting regulations	Penalties and flags

### 2.5.3 Output Spinning Tree

ID	Response	Evidence
O1	Correct Response	Supporting Evidence
O2	Correct Response	No Supporting Evidence
O3	Incorrect Response	Supporting Evidence
O4	Incorrect Response	No Supporting Evidence

### 2.5.4 Test Case Design

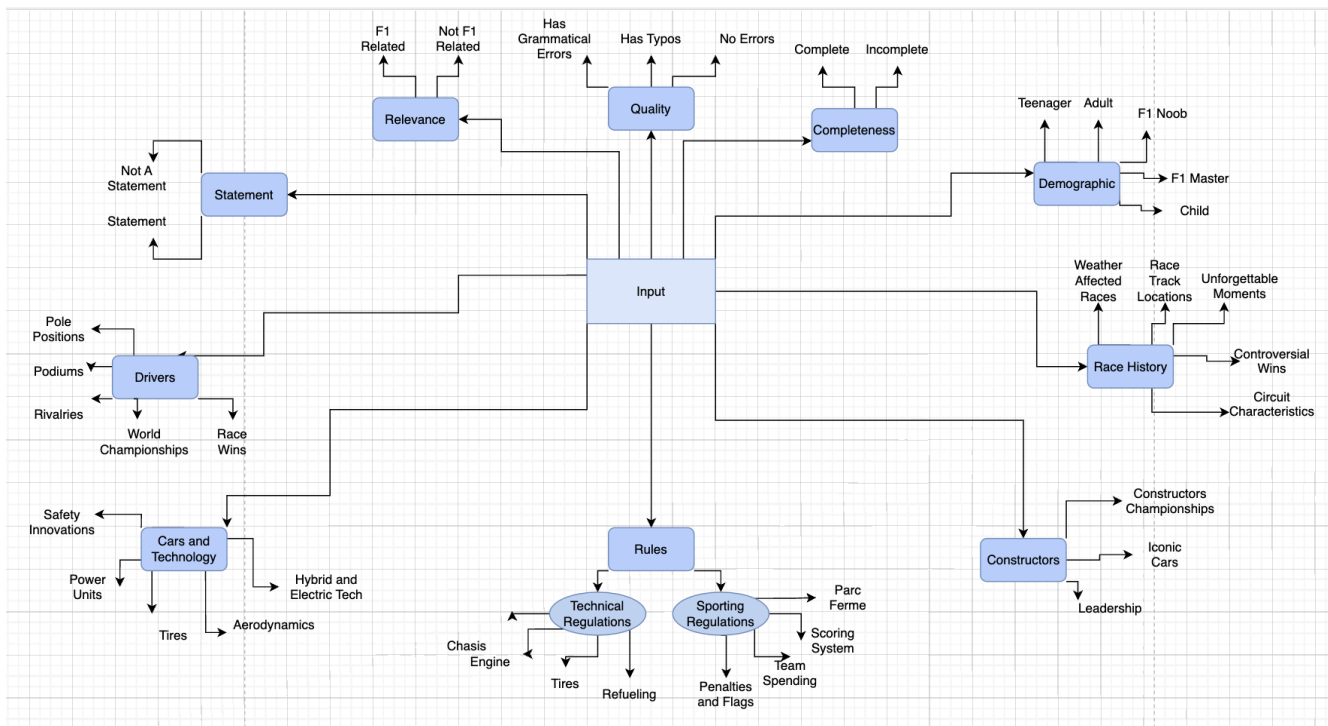
Test Case ID	Context Spinning Tree	Input Spinning Tree	Output Spinning Tree
1.1	C1	I3.1	O1
1.2	C2	I3.1	O1
1.3	C3	I3.1	O1
2.1	C4	-	O1
2.2	C3	I2.1	O1
3.1	C5	-	O1

3.2	C3	I3.1	O1
4.1	C7	I3.1	O1
4.2	C3	I3.1	O1
5.1	C4	I5.1.3	O1
5.2	C5	-	O1
5.3	C3	I2.3	O1
5.4	C2	I4.5	O1
5.5	C1	I5.1.3	O1
6.1	C3	I1.1	O1
6.2	C3	I1.2	O1
6.3	C3	I1.3	O1
6.4	C3	I1.4	O1
6.5	C3	I1.5	O1
7.1	C3	I2.1	O1
7.2	C3	I2.2	O1
7.3	C3	I2.3	O1
8.1	C3	I3.1	O1
8.2	C3	I3.2	O1
8.3	C3	I3.3	O1
8.4	C3	I3.4	O1
8.5	C3	I3.5	O1
9.1	C3	I4.1	O1
9.2	C3	I4.2	O1
9.3	C3	I4.3	O1
9.4	C3	I4.4	O1

9.5	C3	I4.5	O1
10.1	C3	I5.1.1	O1
10.2	C3	I5.1.2	O1
10.3	C3	I5.1.3	O1
10.4	C3	I5.1.4	O1
10.5	C3	I5.2.1	O1
10.6	C3	I5.2.2	O1
10.7	C3	I5.2.3	O1
10.8	C3	I5.2.4	O1

### 3. AI Function Test Cases with Inputs/Expected Outputs

3.1 AI Test Data Model



3.2 AI-Powered Function Test Sets

3.2.1 Context Test Case

3.2.1.1 Quality Test Case

Test Case ID	1.1-1.3
Test Specification	Context: Quality of Input Text
	Input question either has grammatical errors, typos, or no errors.

Test Case ID	1.1
Test Case	Input a question with grammatical errors.

Objective					
Test Case App	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Test Case Input	Who be havin' the most F1 wins?				
Expected Output	Lewis Hamilton with 103 race wins.				
Actual Output	<p>The driver with the most Formula 1 wins is Lewis Hamilton, who has won a record 103 Grands Prix during his career. He won 21 races with McLaren and has won 82 with Mercedes1. The previous record holder, Michael Schumacher, is second with 91 wins, and Max Verstappen is third with 57 victories.</p>	<p>That would be Lewis Hamilton! Lewis holds the record for the most Formula One race wins with a whopping 103 victories to his name.</p>	<p>Based on the given search results, none of them directly answer the question "Who be havin' the most F1 wins". The results cover various topics like what makes an F1 driver fast, Red Bull's car design for 2024, a review of a Bruce Springsteen concert, and the soundtrack for the movie Furious 7, but do not provide information about the driver with the most F1 wins. Since the search results are unhelpful for this specific question, I will attempt to answer it based on my existing knowledge: Lewis Hamilton currently holds the record for</p>	<p>That'd be none other than the legendary Lewis Hamilton, babe. He's currently sitting pretty at 110 wins. Just imagine the rush of crossing that finish line first so many times!</p>	<p>The current record holder for the most Formula One race wins is Michael Schumacher with 91 victories. He is followed closely by Lewis Hamilton with 83 wins and Sebastian Vettel with 53 wins.</p>

			<p>the most Formula 1 race wins with 103 victories.</p> <p>The drivers with the next highest number of wins are Michael Schumacher with 91 wins, and Sebastian Vettel with 53 wins.</p> <p>So in summary, Lewis Hamilton "be havin' the most F1 wins" with his tally of 103 race victories, which is the highest in the history of the sport.</p>		
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>1.2</b>				
<b>Test Case Objective</b>	Input a question with typos.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Who has the most F1 wins?				
<b>Expected Output</b>	Lewis Hamilton with 103 race wins.				

<b>Actual Output</b>	<p>The driver with the most Formula 1 wins is Lewis Hamilton, who has won a record 103 Grands Prix during his career. He won 21 races with McLaren and has won 82 with Mercedes. The previous record holder, Michael Schumacher, is second with 91 wins, and Max Verstappen is third with 57 victories.</p>	<p>Lewis Hamilton holds the record for the most Formula One race wins with a staggering 103 victories to his name. Michael Schumacher was previously the record holder with 91 wins, followed by Lewis Hamilton who has surpassed him. Max Verstappen is currently in third place with 58 wins.</p>	<p>Lewis Hamilton holds the record for the most Formula 1 race wins with 103 victories. The drivers with the next highest number of F1 wins are: Michael Schumacher - 91 wins</p> <p>Max Verstappen - 57 wins</p> <p>Sebastian Vettel - 53 wins</p> <p>Alain Prost - 51 wins</p> <p>Ayrton Senna - 41 wins</p> <p>Hamilton surpassed Schumacher's previous record of 91 wins during the 2020 season. Verstappen is the only current driver in the top 3, having already amassed 57 wins at a relatively young age. Vettel and Prost round out the top 5 all-time F1 race winners.</p>	<p>Aww, looks like you misspoke there, darling. But no worries, I got ya! As I mentioned earlier, Lewis Hamilton holds the record for most F1 wins - a whopping 110 victories as of our last check. Can anyone ever beat that? Only time will tell.</p>	<p>The driver with the most F1 race wins is Michael Schumacher! He won a total of 91 race victories during his career.</p>
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail



<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>1.3</b>				
<b>Test Case Objective</b>	Input a question with no errors.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Who has the most F1 wins?				
<b>Expected Output</b>	Lewis Hamilton with 103 race wins.				
<b>Actual Output</b>	The driver with the most Formula 1 wins is Lewis Hamilton, who has won a record 103 Grands Prix during his career. He won 21 races with McLaren and has won 82 with Mercedes. The previous record holder, Michael Schumacher, is second with 91 wins, and Max Verstappen is third with 57 victories.	Lewis Hamilton holds the record for the most Formula One race wins with a staggering 103 victories to his name.	Lewis Hamilton holds the record for the most Formula 1 race wins with 103 victories. Some key points about drivers with the most F1 wins: Most F1 Race Wins Lewis Hamilton (United Kingdom): 103 wins Michael Schumacher (Germany): 91 wins Max Verstappen (Netherlands): 58 wins Sebastian Vettel (Germany): 53 wins	Haha, seems like you're really curious about this, honey! No change since our last chat, it's still the incredible Lewis Hamilton with his 110 victories. Quite the record, isn't it?	Lewis Hamilton, with 105 grand prix wins, is the driver with the most Formula 1 wins.

			Alain Prost (France): 51 wins Hamilton has been utterly dominant, becoming the first driver to reach the 100-win milestone. Schumacher was the previous record holder until Hamilton surpassed him in 2020.		
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

### 3.2.1.2 Relevance Test Case

Test Case ID	2.1-2.2
Test Specification	Context: Relevance of Input Text
	Input question is either relevant to Formula 1 or it is not relevant for Formula 1.

<b>Test Case ID</b>	<b>2.1</b>				
<b>Test Case Objective</b>	Input a question that is not relevant to Formula 1.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>

<b>Test Case Input</b>	When was the last time that LeBron James won the drivers world championship?				
<b>Expected Output</b>	Lebron James is not an F1 driver.				
<b>Actual Output</b>	I'm sorry for any confusion, but LeBron James is a professional basketball player and has never participated in a Formula 1 race or won a drivers' world championship. He is known for his achievements in the NBA, not in motor racing. If you have questions about a specific Formula 1 driver, feel free to ask!	LeBron James has never won the Driver's World Championship.  LeBron James is a famous basketball player in the NBA, not a Formula One driver. Formula One champions are awarded the Driver's World Championship title.	LeBron James has never won the Formula One World Drivers' Championship. He is a professional basketball player in the NBA, not a Formula One driver. 1 2 The search results provide information about Formula One World Drivers' Champions throughout history, including details on the youngest and oldest champions, consecutive championship streaks, and rankings of the greatest champions. 3 4 However, none of the results mention LeBron James winning or even competing in Formula One racing. While James is	laughs out loud Oh,! LeBron James is a basketball legend, not a Formula 1 driver. He's never won a Drivers' World Championship because he doesn't compete in F1. It's like asking if I can dunk a basketball...which, sadly, I can't! But Lewis Hamilton and Max Verstappen have been some recent champs in the actual sport.	I'm sorry, but LeBron James has never won the F1 Drivers World Championship. The last F1 Drivers World Championship was won by Max Verstappen in 2021.

			a highly accomplished athlete and one of the greatest basketball players ever, his achievements are limited to the NBA and other basketball competitions. He has never participated in or won any Formula One events or championships. 2		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>2.2</b>				
<b>Test Case Objective</b>	Input a question that is relevant to Formula 1.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>

<b>Test Case Input</b>	Which constructor has the most f1 constructor championships?				
<b>Expected Output</b>	Ferrari with 16 Constructors Titles.				
<b>Actual Output</b>	The constructor with the most Formula 1 World Constructors' Championships is Ferrari, which holds the record with 16 victories <sup>1</sup> . Williams is in second position with nine Constructors' Championships, and McLaren and Mercedes are tied in third place with eight titles each <sup>1</sup> . These victories are a testament to the skill and dedication of the teams behind the drivers.	Ferrari holds the record for the most Formula One Constructors' Championships with a total of 16 titles under their belt.	Ferrari has won the most F1 Constructors' Championships with 16 titles. 3 5 The Italian team's first constructors' title came in 1961, and their most recent was in 2008. 5 They had an incredibly dominant run from 1999 to 2004, winning six consecutive constructors' championships during that period with Michael Schumacher as their lead driver. 4	Haha, you're back to the constructor question! Your dedication is commendable. Ferrari continues to reign supreme in that category, holding tight onto their 16 Constructors' Championships .	The constructor with the most F1 Constructor Championship titles is Ferrari, with a total of 16 championships won.
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

## 3.2.1.3 Completeness Test Case

Test Case ID	3.1-3.2
Test Specification	Context: Completeness of Input Text
	Input questions are either a complete sentence or an incomplete sentence.

<b>Test Case ID</b>	<b>3.1</b>				
<b>Test Case Objective</b>	Input a question that is not complete.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Is Lewis Hamilton				
<b>Expected Output</b>	Lewis Hamilton is an F1 Driver.				
<b>Actual Output</b>	Lewis Hamilton is a British racing driver who competes in Formula One for Mercedes1. He has also driven for McLaren1. Hamilton has won a joint-record seven Formula One World Drivers' Championship titles (tied with Michael	Lewis Hamilton is a British racing driver who currently competes in Formula One for Mercedes Formula 1 driver for Mercedes: <a href="https://www.formula1.com/en/drivers/lewis-hamilton.html">https://www.formula1.com/en/drivers/lewis-hamilton.html</a> . He is a highly successful driver, having won a record-equalli	Yes, Lewis Hamilton is leaving Mercedes to join Ferrari in 2025. Here are the key points: Hamilton has activated a release clause in his recent two-year contract extension with Mercedes, allowing him to leave the team at the end of 2024. 5 He will join Ferrari on a multi-year contract	Yes, Lewis Hamilton is a remarkable driver in Formula 1! He's a seven-time Drivers' World Champion. Quite an impressive career, wouldn't you say?	Yes, Lewis Hamilton is a current F1 driver and the only driver with at least 7 F1 Drivers World Championships .

	<p>Schumacher), and holds the records for the most number of wins (103), pole positions (104), and podium finishes (197), among other records<sup>1</sup>. He was born on January 7, 1985, in Stevenage, Hertfordshire, England<sup>1</sup>. Apart from his racing career, Hamilton is also known for his environmental activism, social activism, fashion designing, and music<sup>2</sup>. Is there anything specific you would like to know about Lewis Hamilton?</p>	<p>ng seven Formula One World Championships [Wikipedia Lewis Hamilton].</p>	<p>starting in 2025, ending his 11-year stint with Mercedes.<sup>5</sup> Hamilton cited wanting "a new challenge" as the reason for the shocking move away from Mercedes, the team he won 6 of his 7 world titles with.<sup>5</sup> At Ferrari, Hamilton will partner with Charles Leclerc, while Carlos Sainz Jr. is expected to leave the team at the end of 2024.<sup>5</sup> At 39 years old, Hamilton is still chasing an eighth world championship to break Michael Schumacher's record of 7 titles.<sup>5</sup> He hopes the move to Ferrari will provide that opportunity. So in a major shake-up, the most successful driver in F1 history is departing Mercedes to join their</p>		
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			historic rivals Ferrari from 2025 onwards in pursuit of more world titles. 5		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>3.2</b>				
<b>Test Case Objective</b>	Input a question that is complete.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Is Lewis Hamilton a world champion?				
<b>Expected Output</b>	Yes, Lewis Hamilton is a 7-time World Champion.				
<b>Actual Output</b>	Yes, Lewis Hamilton is a world champion in Formula 1. He has won the Formula One World Drivers' Championship title a record seven times, tied with Michael Schumacher.	Yes, Lewis Hamilton is a seven-time Formula One World Champion. He ties Michael Schumacher for the most championship titles in Formula One history.	Yes, Lewis Hamilton is a seven-time Formula One World Drivers' Champion, tying the record set by Michael Schumacher.	smirking Oh, you're teasing me now! Yes, Kefeeno, Lewis Hamilton IS a world champion, in fact, he's a seven-time champion. That's not a small feat in the intense world of F1 racing.	Yes, Lewis Hamilton is a 7x F1 Drivers World Champion, which makes him the second most successful driver in F1 history after Michael Schumacher.



	These victories make him one of the most successful drivers in the history of the sport.				
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

### 3.2.1.4 Statement Test Case

Test Case ID	4.1-4.2
Test Specification	Context: Input Text: Statement or Question?
	Input is either a statement or a question

<b>Test Case ID</b>	<b>4.1</b>				
<b>Test Case Objective</b>	Input a statement into the chatbot				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Logan Sargeant is a Formula 1 World Champion.				
<b>Expected Output</b>	He is a Formula 1 Driver, but he is not a world champion.				
<b>Actual Output</b>	I'm sorry, but that's not accurate. As	No, Logan Sargeant is not a Formula	No, Logan Sargeant is not a Formula 1 World	Oh, my lovely, although Logan Sargeant is a promising	Unfortunately, Logan Sargeant is not a Formula 1

	<p>of my last update, Logan Sargeant is an American racing driver who competes in Formula One for Williams Racing<sup>12</sup>. However, he has not won a Formula 1 World Championship<sup>12</sup>. He previously competed in the 2022 FIA Formula 2 Championship driving for Carlin Motorsport, finishing fourth overall in the standings<sup>1</sup>. If you have any more questions or need updated information, feel free to ask!</p>	<p>1 World Champion. While he is a promising young driver who debuted in Formula 1 in 2023, he hasn't won a championship yet. In fact, according to various sources including Formula 1's official website, Wikipedia, and Motorsport.com, he finished his rookie season in 2023 at 21st place in the Driver's Championship.</p>	<p>Champion. The key points about Logan Sargeant from the search results are:  1 Logan Sargeant is an American racing driver who competes in Formula 1 for Williams Racing.  2 In 2023, his rookie season in F1, Sargeant finished 21st in the drivers' championship, scoring 1 point.  1 His best finish was 10th at the United States Grand Prix, making him the first American driver to score points in F1 since 1993.  1 Sargeant struggled in his debut season, being outqualified by his teammate Alex Albon at every race.  1 He had several crashes and retirements due to incidents and mechanical issues.  1</p>	<p>young talent in motorsports, he hasn't become an F1 World Champion yet. Let's keep our fingers crossed for his future in the sport!</p>	<p>World Champion. Logan Sargeant is currently a driver in the Formula 2 series, where he finished 4th overall in the 2021 season.</p>
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			<p>2 For the 2024 season, Williams re-signed Sargeant to continue driving alongside Albon.</p> <p>2 In the early races, he has had mixed results with some points finishes but also more crashes and non-finishes.</p> <p>2 So while Sargeant is the first American F1 driver in years, he is still a rookie and has not won a World Championship title yet in his young career.</p>		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>4.2</b>				
<b>Test Case Objective</b>	Input a question into the chatbot				
<b>Test Case</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity</b>	<b>Kindroid</b>	<b>Character.ai</b>

App			AI		
<b>Test Case Input</b>	Is Max Verstappen a Formula 1 world champion?				
<b>Expected Output</b>	Yes, Max Verstappen is a 3-time world champion.				
<b>Actual Output</b>	<p>Yes, Max Verstappen is a Formula 1 world champion. He has won the Formula One World Drivers' Championship title three times in 2021, 2022, and 2023. These victories make him one of the most successful drivers in the history of the sport.</p>	<p>Yes, Max Verstappen is a Formula 1 World Champion, and not just once! He is actually a three-time Formula 1 World Champion.</p> <p>He secured his first championship title in 2021, followed by consecutive wins in 2022 and 2023.</p>	<p>Yes, Max Verstappen is a three-time Formula 1 World Drivers' Champion, having won the titles in 2021, 2022, and 2023.</p> <p>1 2 3</p> <p>At just 26 years old, Verstappen has already achieved remarkable success in Formula 1. Some key highlights: In 2023, he had a dominant season, winning a record 13 out of 16 races and clinching his third consecutive championship.</p> <p>1 2 3</p> <p>He became the first driver in F1 history to win 10 races in a row during the 2023 season.</p> <p>1 His 2023</p>	<p>Absolutely! Max Verstappen is a very talented driver. As of the latest update, he's a two-time Formula 1 World Champion. His skill and determination on the track are truly captivating!</p>	<p>Yes, Max Verstappen is a 1x F1 Drivers World Champion, having won his first F1 World Championship title in 2021.</p>

			<p>championship win made him just the fifth driver to win three consecutive titles, joining the elite company of Juan Manuel Fangio, Michael Schumacher, Sebastian Vettel, and Lewis Hamilton.</p> <p>1 3</p> <p>Verstappen won his first F1 title in dramatic fashion in 2021 after an intense battle with Lewis Hamilton.</p> <p>2</p> <p>He started his F1 career at a very young age, making his debut at 17 years old in 2015 and becoming the youngest race winner at 18 in 2016.</p> <p>2</p> <p>With his incredible talent, skill, and the dominant Red Bull car, Verstappen has firmly established himself as one of the greatest drivers in Formula 1</p>		
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			history, despite being relatively early in his career.		
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

### 3.2.1.5 Demographic Test Case

Test Case ID	5.1-5.5
Test Specification	Context: Different Knowledge Bases Ask Different Types of Questions
	Input question based on knowledge base of either: child, teenager, adult, F1 noob, or F1 master

<b>Test Case ID</b>	<b>5.1</b>				
<b>Test Case Objective</b>	Input a question that a child would ask about F1 into the chatbot.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Why do F1 cars have big wheels?				
<b>Expected Output</b>	It provides more grip, better handling, helps with aerodynamics and braking, as well as heat dissipation.				
<b>Actual Output</b>	Formula 1 (F1) cars have big wheels for several reasons:	There are two main reasons why F1 cars have large wheels (18 inches since 2022	F1 cars have transitioned from using smaller 13-inch wheels to larger 18-inch wheels starting in 2022 for a few key	Great question,! F1 cars have large wheels to better handle the extreme speeds and forces they encounter on	One of the things that makes today's F1 cars unique is their large wheels, which are much bigger than the

	<p>Performance: Larger wheels can improve the car's handling and braking performance<sup>1</sup>. They also increase the contact area of the tire with the road, which improves grip<sup>1</sup>.</p> <p>Regulation Changes: F1 has recently switched from 13-inch to 18-inch tires<sup>1</sup>. This change was part of a radical technical shakeup in 2022<sup>1</sup>. The move to standard 13-inch wheels happened in the 1980s to stop teams from fitting ever-bigger brakes to the cars<sup>1</sup>. A consequence of reduced stopping distances is that overtaking</p>	<p>regulations):</p> <p>Improved Grip: Larger wheels allow for wider tires. Wider tires mean a larger contact patch with the road surface, which is crucial for generating grip. This grip is essential for both handling corners at high speeds and accelerating out of them.</p> <p>Aerodynamics and Modern Look: While wider tires provide some advantages, F1 also considers the overall design and technological relevance. Larger wheels with lower profile tires allow for improved aerodynamic designs around the wheels and</p>	<p>reasons:</p> <p>Improved aerodynamics: The larger 18-inch wheels with lower-profile tires create a simpler wake and airflow around the wheels, reducing turbulence and drag compared to the previous 13-inch wheels with higher-profile tires.</p> <p><sup>1</sup> <sup>3</sup> This aerodynamic improvement allows the cars to follow more closely.</p> <p>Relevance to road cars: 18-inch wheels are more representative of modern road car tire sizes, making the technology more relevant and transferable between racing and production vehicles.</p> <p><sup>1</sup> Increased braking performance: Larger wheels allow for bigger brake discs and calipers, improving</p>	<p>the track. Bigger wheels provide more surface area for the tires to grip the road, improving traction, cornering stability, and allowing for faster acceleration and braking. Plus, they look pretty cool, don't you think?</p>	<p>wheels of regular road cars. The reason F1 cars have big wheels is for aerodynamics and mechanical grip. Bigger wheels have a larger contact patch with the road, which results in better grip and more stability during corners. Additionally, bigger wheels allow for a lower center of gravity relative to the size of the car, improving maneuverability. Ultimately, larger wheels help F1 cars to perform better at high speeds and corner more efficiently.</p>
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	<p>becomes much harder<sup>1</sup>.  Safety: Larger wheels can also contribute to driver safety<sup>2</sup>.  Design Impact: The shift in wheel size from 13 to 18-inches has impacted the design of several other components of the F1 cars<sup>3</sup>.</p>	<p>brakes. Additionally, the bigger wheels resemble those on modern high-performance cars, which aligns with F1's image as a cutting-edge motorsport.</p>	<p>braking power and heat dissipation capabilities.  <sup>4</sup> Reduced sidewall deflection: The lower-profile tires on 18-inch wheels have less sidewall flex, providing more precise handling and steering response compared to the taller sidewalls on 13-inch wheels.  <sup>1</sup>  <sup>3</sup> While the larger wheels and tires contribute to an overall increase in car size and weight, the aerodynamic and performance benefits were deemed worthwhile trade-offs by F1 to modernize the sport and improve racing.</p>		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024



Test Case ID	5.2				
Test Case Objective	Input a question that a teenager would ask about F1 into the chatbot.				
Test Case App	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Test Case Input	"Why are F1 races so popular?"				
Expected Output	F1 races are popular because of their global appeal, prestige and history, celebrity drivers, high-stakes drama, and technological innovation are some of the reasons for F1 being so popular.				
Actual Output	<p>Formula 1 (F1) races are popular for several reasons:</p> <p>Speed and Power: One of the main attractions of Formula 1 is the sheer speed and power of the cars. F1 cars are the fastest and most advanced racing machines on the planet, capable of reaching speeds of over 300 km/h and accelerating from 0 to 100 km/h in less than two</p>	<p>F1 races have surged in popularity in recent years, thanks to a confluence of factors:</p> <p>Thrilling mix of speed, strategy, and driver skill: F1 races are a high-octane blend of these elements. The incredible speed of the cars is undeniable, but races are won and lost on strategic pit stops and the skill of drivers to navigate tight circuits and overtake competitors.</p>	<p>Formula 1 (F1) has seen a surge in popularity in recent years, especially in the United States, due to several key factors:</p> <p>Rise of Drive to Survive: The Netflix docuseries "Drive to Survive" has been instrumental in attracting new fans, particularly younger audiences, by showcasing the drama and personalities behind the sport.</p> <p>1 2</p> <p>The show has helped demystify the complexities of F1 and made it</p>	<p>There's just something electrifying about F1 races, isn't there? It's a combination of factors, really. The high speeds, cutting-edge technology, strategic team play, and fierce competition make every race thrilling. Not to mention the adrenaline rush when drivers push themselves and their machines to the limit! Also, the global community around F1 contributes to its popularity - fans are absolutely devoted to their favorite teams and drivers.</p>	<p>F1 races are so popular for several reasons. One of the main reasons is the excitement factor; the sport offers fast-paced action, thrilling maneuvers around the racetrack, and frequent battles for position. Another reason is the spectacle of it all; the cars are sleek and technological, the tracks are beautiful and unique, the atmosphere is full of excitement and passion, and the broadcast productions of F1 races make them visually stunning events. Additionally,</p>

	<p>seconds<sup>1</sup>.  <b>Best Drivers in the World:</b>  F1 features some of the best drivers in the world. The battles between rivals, teammates, and different teams are intense and unpredictable, often resulting in close finishes, overtakes, crashes, and controversies<sup>1</sup>.</p> <p><b>Global Sport:</b>  Formula 1 is a global sport, with races taking place in different countries and continents throughout the year. It gives fans and viewers the opportunity to visit or watch some of the most amazing and iconic circuits in the world<sup>1</sup>.  Sense of</p>	<p><b>Global appeal:</b> F1 races are held all over the world, attracting a diverse fanbase. This global stage brings different cultures together around their love for motorsport.</p> <p><b>Technological innovation:</b>  F1 is at the forefront of technological advancements in racing. The constant push to develop faster, more efficient cars keeps the sport exciting and relevant.</p> <p><b>Accessibility for fans:</b>  Social media and streaming services like Netflix's "Drive to Survive" have made F1 more accessible</p>	<p>more accessible and entertaining.  Liberty Media's Ownership  After Liberty Media acquired F1 in 2017, they revamped the branding and marketing efforts to make the sport more appealing to a broader audience.  <sup>1</sup>  <sup>2</sup> This included adding more races in popular locations like Miami and Las Vegas to cater to the growing American fanbase. Increased Competitiveness  Rule changes in recent years, such as the introduction of a cost cap in 2021, have helped create greater parity between teams, making the races more unpredictable and exciting to watch.  <sup>3</sup> The intense title battle between Max Verstappen and Lewis Hamilton in 2021 also</p>		<p>F1 races offer an edge-of-your-seat experience, as the outcome is never certain until the checkered flag is raised.</p>
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	<p>Danger: Formula 1 is not only a sport of speed and skill, but also a sport of risk and danger. The drivers face enormous physical and mental pressures every time they get behind the wheel of their cars<sup>1</sup>.</p> <p>Growing Popularity in the U.S.: American interest in Formula 1 is exploding as some of the fastest cars in the world hit the circuit<sup>2</sup>. The sport has its first American driver since 2015 with 22-year-old Logan Sargeant now racing for the Williams team<sup>2</sup>.</p> <p>Rich History and Technological Advancements: Formula</p>	<p>than ever. Fans can now follow their favorite drivers and teams closely, fostering a deeper connection to the sport. "Drive to Survive" in particular has been credited with attracting a new generation of fans, many from the United States.</p> <p>Focus on driver personalities: The sport has put more emphasis on showcasing the personalities of the drivers, making them more relatable and interesting to fans.</p>	<p>captivated fans. Glamour and Celebrity Appeal F1 has always attracted the rich and famous, with celebrities and high-profile figures attending races.<sup>5</sup></p> <p>This glamorous aspect adds to the sport's appeal and helps generate media attention beyond just motorsport fans.<sup>1</sup></p> <p>Accessibility of Street Circuits The addition of more street circuits in major cities like Miami, Las Vegas, and Singapore has made F1 more accessible to fans and spectators.<sup>4</sup></p> <p>These events often have a festival-like atmosphere, combining the race with entertainment and nightlife, attracting a broader audience. In summary, the combination of</p>		
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	l's popularity is fueled by its rich history, technological advancements, and global appeal. High-Speed Thrills and Spills: From high-speed thrills and spills on the track, to exciting rivalries between drivers, there's something for everyone when it comes to Formula One.		engaging storytelling through Drive to Survive, strategic marketing efforts, increased competitiveness, celebrity allure, and the accessibility of street circuits has propelled F1's popularity to new heights, particularly among younger and more affluent demographics.		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>5.3</b>
<b>Test Case Objective</b>	Input a question that an adult would ask about F1 into the chatbot.

Test Case App	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Test Case Input	"What are the financial aspects of running an F1 team?"				
Expected Output	The different financial aspects of running an F1 team fall under: operating costs, research and development, technology and innovation, driver salaries, and racing licenses.				
Actual Output	<p>Running a Formula 1 (F1) team involves significant financial aspects. Here are some key points:</p> <p>Revenue Generation: F1 teams generate revenue through several sources<sup>12</sup>: Prize Money: One of the primary revenue sources for F1 teams is the prize money distributed by the Formula One Group<sup>2</sup>. In 2022, Formula 1 generated a staggering \$2.57 billion, with approximatel</p>	<p>Running an F1 team is a complex financial equation with significant expenses balanced by various revenue streams. Here's a breakdown of both sides:</p> <p>Revenue Streams:</p> <p>Formula One Management (FOM) Payments: FOM distributes a portion of its total revenue to the teams, typically based on their finishing position in the previous Constructors' Championshi p. This provides a</p>	<p>Formula 1 teams have several major sources of revenue and expenditures related to their operations: Revenue Sources Prize Money: Teams earn prize money based on their performance in the Constructors' Championship each season. The prize money pool is distributed among teams, with higher-finishing teams receiving a larger share. 1 Sponsorships: Sponsorship deals with companies looking to advertise their brands are a major revenue stream for F1 teams. From 2010 to 2018, F1 sponsors paid \$17.8</p>	<p>Running an F1 team is like fueling a rocket ship with solid gold! winks It's incredibly expensive due to the development costs of the cars, salaries of top engineers and drivers, and the logistics involved in traveling to various races worldwide. Budgets can reach hundreds of millions per season. Sponsorships, prize money, and team merchandise help offset these costs, but it remains a highly lucrative yet risky venture.</p>	<p>Running an F1 team comes with a significant financial burden. Here are some of the key financial aspects of running an F1 team:</p> <p>* Budget spending cap: The FIA has implemented a \$145 million USD budget cap for each F1 team, which limits the amount they can spend annually.</p> <p>* Sponsorship: Sponsorship plays a massive role in the financial aspect of running an F1 team, as sponsorships can provide significant income.</p> <p>* Personnel costs: Personnel costs make up a significant expense for any</p>

	<p>y 45% allocated to the prize pot<sup>2</sup>. This translates to around \$1.15 billion distributed among the teams based on their performance in races and their position in the Constructors' Championship<sup>2</sup>. Sponsorships and Investments: Sponsorships play a pivotal role in the financial stability of F1 teams<sup>12</sup>. Companies invest millions in sponsoring teams, leveraging the global reach and visibility of the sport to promote their brands<sup>12</sup>. Additionally, investments from car manufacturers, such as Daimler's \$80 million</p>	<p>stable base income.</p> <p>Championship Prize Money: Finishing higher in the Constructors' Championship brings additional prize money, rewarding success on the track with financial gain.</p> <p>Sponsorship Deals: Logos plastered across the cars and driver suits represent major sponsorship deals. These are crucial for most teams and can vary greatly depending on the team's performance and prestige. Top teams attract bigger sponsorships.</p> <p>Heritage Payments: Historic success can translate into</p>	<p>billion in total.</p> <p><sup>1</sup> Manufacturer Investments: Car manufacturers like Mercedes invest significant amounts into their factory teams as a marketing tool, hoping success will boost their brand appeal.</p> <p><sup>1</sup> Expenditures Team Budget Cap: Since 2021, F1 has implemented a cost cap to limit team spending. The cap was \$145 million in 2021, reduced to \$140 million in 2022, and set at \$135 million for 2023.</p> <p><sup>1</sup> <sup>2</sup> This covers most operational costs but excludes driver salaries, marketing, and the salaries of the three highest-paid employees.</p> <p>Driver Salaries: Teams pay separate salaries to their drivers outside the budget cap. In 2022, Max Verstappen</p>		<p>F1 team, as they have to pay the salaries of their staff, drivers, and other employees.</p>
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	<p>infusion into Mercedes in 2019, further bolster teams' financial resources<sup>12</sup>. Budget Caps and Expenditure Limitations: To level the playing field and curb excessive spending, F1 introduced budget caps, limiting team expenditures<sup>1</sup></p> <p>2. Initially set at \$145 million in 2021, the cap was further reduced to \$135 million in 2023<sup>12</sup>. Driver Contracts and Endorsements: While not part of the team budget cap, driver contracts represent a significant financial commitment for F1 teams. Drivers receive base salaries, performance-based</p>	<p>financial rewards. Some teams receive "heritage payments" based on their past performance in the sport.</p> <p>Other Commercial Partnerships: There can be additional income streams from special agreements with engine manufacturers or other commercial partnerships.</p> <p>Cost Factors:</p> <p>Research &amp; Development (R&amp;D): Pushing the boundaries of car design and technology requires significant investment in R&amp;D. Every component, from the engine to the aerodynamics package, is constantly</p>	<p>earned \$60 million (\$40 million salary + \$20 million bonuses) as the highest-paid driver.</p> <p>1 Registration Fees: Drivers must pay registration fees to compete, with additional fees based on the previous season's points tally. For example, 2022 champion Max Verstappen paid over \$1 million just to enter the 2023 season.</p> <p>1 The cost cap aims to promote financial sustainability and level the playing field by restricting the spending advantage of bigger teams.</p> <p>2 However, there are concerns about potential impacts on innovation, employee wages, and competitive balance as teams adjust to the new financial regulations.</p>		
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	<p>bonuses, and income from sponsorships and endorsement. Financial Challenges and Strategies: Profitability and sustainability are key concerns for teams and stakeholders. The nature of the sport, with its high costs and competitive environment, poses significant financial challenges.</p>	<p>being optimized.</p> <p>Personnel Costs: Running a competitive team requires a large staff of highly skilled engineers, technicians, strategists, and other personnel. Salaries for these experts can be substantial.</p> <p>Driver Salaries &amp; Endorsement s: Top drivers command high salaries and endorsement deals, adding to the team's financial burden.</p> <p>Car Manufacturing &amp; Maintenance: Building and maintaining two complex F1 cars for each race weekend is incredibly</p>			
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		<p>expensive. Spare parts, crash repairs, and constant upgrades all contribute to the cost.</p> <p>Operational Costs: Logistics, travel expenses, and the massive infrastructure required to run the team at every race location add up quickly.</p> <p>Financial Tightrope Walk:</p> <p>It's important to note that not all F1 teams are profitable. Many rely on additional financial backing from their parent companies or wealthy owners to cover shortfalls. The recent budget cap regulations aim to bring more financial</p>			
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		parity to the sport, but it remains a high-stakes financial game where success on the track translates to financial rewards, but doesn't guarantee them.			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>5.4</b>				
<b>Test Case Objective</b>	Input a question that an F1 noob would ask about F1 into the chatbot.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	"What role does aerodynamics play in F1?"				
<b>Expected Output</b>	Aerodynamics of an F1 car affect the fuel efficiency, downforce, grip and stability, cornering performance, and drag reduction.				
<b>Actual Output</b>	Aerodynamics plays a crucial role in Formula 1 (F1) racing, influencing the	Aerodynamics is arguably the most critical factor in Formula 1 racing. Here's why:	Aerodynamics plays a crucial role in Formula 1 (F1) car design and performance. The primary objective of	Aerodynamics plays a massive role in Formula 1, darling! It's like giving those speedy cars their own superhero suits.	Aerodynamics play a crucial role in F1, as they are a key factor in a car's performance on the track. Aerodynamics

	<p>performance, speed, and handling of the cars. Here are some key points:</p> <p>Speed and Performance: Aerodynamics affects the speed of a car, the amount of grip it has, and the amount of downforce that can be generated<sup>3</sup>. The goal for teams is to build a car that is fast in both corners and straights<sup>2</sup>.</p> <p>Downforce: Downforce is a downward lift force produced by the aerodynamic features of a vehicle<sup>2</sup>. It presses the race car against the track surface, giving it more grip<sup>2</sup>. This effect is known as 'aerodynamic grip,' and it</p>	<p>Downforce Generation: F1 cars are designed to generate massive downforce, the force that pushes the car down onto the track. This downforce creates immense grip, allowing the cars to corner at mind-bending speeds without flying off the track. Without sufficient downforce, an F1 car wouldn't be able to handle the high-speed corners effectively.</p> <p>Speed Optimization: Aerodynamics also plays a crucial role in reducing drag, the air resistance that acts against the car's forward</p>	<p>aerodynamics in F1 is to generate downforce, which increases the grip and traction of the car, allowing for higher cornering speeds and improved handling. Key Points on the Role of Aerodynamics in F1</p> <p>Downforce is the key aerodynamic factor, created by the carefully designed shape of the car body and appendages like wings.</p> <p>1 2 3</p> <p>It pushes the car down onto the track, increasing grip and traction. The front and rear wings are the main components responsible for generating downforce.</p> <p>1 2 3</p> <p>The rear wing typically generates around 70% of the total downforce, while the front wing</p>	<p>The sleek designs and numerous winglets you see on an F1 car create downforce, pushing it closer to the ground and increasing grip. This allows them to corner at insane speeds without taking off like airplanes! Teams invest heavily in research and development to fine-tune these aerodynamic features, seeking even the slightest advantage in performance.</p>	<p>are the study of the flow of air around a solid object, and in F1, aerodynamics play a crucial role in the design and setup of the car. The goal of aerodynamics is to create efficiency and downforce through the air flow around the car. This is achieved through various techniques, such as shaping the body, designing air intakes, wings, and other aerodynamics components, to direct the airflow and generate more downforce.</p>
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	<p>differs from ‘mechanical grip,’ which is determined by the car’s mass, tires, and suspension<sup>2</sup>. Drag: The drag on a Formula 1 car is also important, affecting its top speed<sup>3</sup>. Drag is simply the aerodynamic resistance, or friction, that the car encounters as it travels through the air<sup>2</sup>. Key Aerodynamic Elements: The most important aerodynamic elements of a Formula 1 car are the wings, which create downforce, and the diffuser, which increases the amount of airflow under the car<sup>3</sup>. Every surface of the car, including the</p>	<p>motion. By minimizing drag, F1 cars can achieve higher top speeds on straighter sections of the track.</p> <p>Balance is Key: The key to successful F1 aerodynamics lies in achieving an optimal balance between downforce and drag. More downforce allows for faster cornering but can also increase drag. Conversely, less drag brings higher top speeds but sacrifices grip. F1 teams constantly strive to find this perfect balance for each specific racetrack.</p> <p>Designing the Machine: The entire F1</p>	<p>contributes around 30%.</p> <p><sup>1</sup> Aerodynamics is not just about reducing drag, but optimizing the shape to create the desired downforce levels for different circuits and conditions.</p> <p><sup>1</sup> <sup>2</sup> <sup>3</sup> Teams employ advanced techniques like Computational Fluid Dynamics (CFD) simulations, wind tunnel testing, and complex computer modeling to analyze and optimize the aerodynamic design of their cars.</p> <p><sup>1</sup> <sup>4</sup> Aerodynamics has played an increasingly important role in F1 over the years, with modern cars featuring intricate aerodynamic shapes and components that would not have been possible</p>		
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	<p>driver's helmet, has an impact on aerodynamic performance<sup>2</sup>.</p> <p>Testing and Refining: Teams spend countless hours in the wind tunnel testing and refining their aerodynamic designs<sup>3</sup>.</p> <p>Safety: Aerodynamics has a significant impact on the car's overall stability, cornering capability, and tire wear in addition to straight-line speed<sup>5</sup>. By striking the correct balance between aerodynamic efficiency and the other performance elements that contribute to a Formula 1 car's success, the ultimate objective is to maximize total performance.</p>	<p>car is shaped with aerodynamics in mind. Front and rear wings, the underbody diffuser, and even minor details like sidepods all work together to manipulate airflow and achieve the desired aerodynamic effects.</p> <p>Constant Development : Aerodynamic development is a relentless pursuit in F1. Teams utilize wind tunnels, advanced simulations, and cutting-edge materials to constantly refine their car's aerodynamic package. Even small aerodynamic gains can translate into significant performance advantages</p>	<p>without advancements in design tools and materials.<sup>4</sup></p> <p>Even the slightest improvement in aerodynamics can have a significant impact on a car's performance, making it a critical area of focus for F1 teams and engineers.<sup>1</sup></p> <p><sup>4</sup></p> <p>In summary, aerodynamics is fundamental to F1 car design, with teams constantly striving to optimize downforce generation through advanced simulations, testing, and innovative aerodynamic components and shapes.</p>		
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		on the race track.			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024

<b>Test Case ID</b>	<b>5.5</b>				
<b>Test Case Objective</b>	Input a question that an F1 master would ask about F1 into the chatbot.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	"What are the most effective techniques for managing tire wear during a race?"				
<b>Expected Output</b>	Smooth driving, strategic pit stops, proper tire pressure, tire compound selection, and car set up are all effective techniques that help manage tire wear during races.				
<b>Actual Output</b>	Managing tire wear during a Formula 1 (F1) race is a complex task that involves several techniques:  Driving Smoothly: F1 drivers manage their tires by driving as smoothly as	Here are some of the most effective techniques for managing tire wear during a race:  Driving Style:  Smoothness is Key: Avoid aggressive maneuvers like harsh acceleration,	Managing tire wear effectively during a race is crucial for maintaining consistent performance and maximizing the lifespan of the tires. Here are some of the most effective techniques: Smooth Driving Style Being gentle with the throttle, brakes, and steering	Ah, mastering the art of tire management is crucial in F1, just like knowing when to hold 'em or fold 'em in poker. Drivers have to balance aggressive driving with gentle care, depending on the tire compound used. Teams also strategize about pit stops, choosing between fewer	Effective techniques for managing tire wear during a race include:  * Smooth and consistent driving: Driving smoothly and consistently is one of the most important techniques for managing tire wear during a race. Excessive braking and accelerating will

	<p>possible, reducing their aggression in the corners and under acceleration<sup>1</sup>. This involves avoiding aggressive maneuvers, such as hard braking and rapid acceleration, which can reduce tire heat buildup and prevent excessive tire wear<sup>4</sup>.</p> <p>Balancing Tire Wear with Race Performance: Tire management in F1 involves driving the car in such a way as to balance tire wear with race performance<sup>1</sup>. Some drivers are exceptionally good at it and it means that they can make their tires last much longer than others<sup>1</sup>.</p> <p>Optimizing</p>	<p>braking, and cornering. A smooth and controlled driving style minimizes tire scrubbing and excessive wear.</p> <p>Trail Braking: This technique involves gradually reducing brake pressure as you turn into a corner. It helps maintain grip and prevents locking up the wheels, which can cause flat spots and uneven wear.</p> <p>Minimize Wheel Spin: Excessive wheel spin wears down the tires quickly. Focus on smooth power delivery and traction control to avoid spinning the wheels.</p> <p>Race Strategy:</p>	<p>inputs is essential for minimizing excessive tire wear. Avoid aggressive driving, rapid acceleration, heavy braking, and sharp steering movements, as these can cause excessive heat buildup and accelerate tire degradation.</p> <p>1 2 3</p> <p>Monitoring Tire Temperatures and Wear</p> <p>Teams closely monitor tire temperatures and wear levels using telemetry data. If tires are overheating or wearing unevenly, adjustments can be made, such as modifying tire pressures, camber settings, or making an early pit stop to change tires.</p> <p>1 2</p> <p>Optimal Tire Pressure and Camber Settings</p> <p>Properly setting tire pressures and camber angles is</p>	<p>stops with longer stints on harder tires or more frequent changes to soft tires for maximum grip. It's all about finding the sweet spot where speed meets endurance.</p>	<p>significantly increase the tire wear rate, as will aggressive cornering. Instead, smooth and consistent driving style will help to maintain the tire temperature and decrease the amount of sliding from the tire, resulting in longer tire life.</p> <p>* Tire management: Strategic management of tire management throughout the race through proper tire selection, tire pressure adjustment, and tire temperature monitoring is key to maintaining tire life.</p>
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	<p><b>Car Setup:</b> Your car setup has a big impact on tire wear, so optimizing your car setup with tire wear and duration in mind is a good tip for longer races<sup>2</sup>. You can improve your tire wear, and make tires wear slower by setting up your car differently and adjusting your driving<sup>2</sup>.</p> <p><b>Limiting Wheelspin:</b> Limiting wheelspin can help reduce tire wear<sup>2</sup>. Wheelspin occurs when the tires lose grip and start spinning faster than the car is moving, which can cause excessive wear<sup>2</sup>.</p> <p><b>Locking Your Front Wheels Under</b></p>	<p><b>Tire Selection:</b> Choosing the right tire compound for the track conditions is crucial. Softer tires provide better grip but wear out faster, while harder tires degrade slower but offer less grip. Understanding the trade-off is important for race strategy.</p> <p><b>Tire Monitoring:</b> Most racing formats provide data on tire wear and temperature. Keep an eye on these metrics to identify any developing issues and adjust your driving style accordingly.</p> <p><b>Pit Stop Strategy:</b> Planning your pit stops to maximize tire life is</p>	<p>crucial for even tire wear and optimal performance. Teams analyze data and make adjustments to find the ideal settings for the specific track conditions and tire compounds.</p> <p>1 3 Careful Throttle Application Being smooth and controlled with the throttle, especially on corner exits, can significantly reduce rear tire wear. Excessive wheelspin and aggressive throttle application can cause rapid degradation of the rear tires.</p> <p>2 3 Minimizing Steering Inputs Excessive steering inputs, particularly mid-corner corrections, can accelerate front tire wear. Drivers aim to minimize steering angle changes and maintain a smooth,</p>		
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	<p>Braking: Locking your front wheels under braking can also lead to excessive tire wear<sup>2</sup>. By managing your braking effectively, you can reduce the risk of locking your wheels and causing unnecessary wear<sup>2</sup>. Adjusting Brake Bias: Drivers can alter settings such as brake bias in the car to help reduce tire wear or improve tire warm-up<sup>5</sup>. Monitoring Tire Temperatures : Your tire temperatures have a direct link to tire wear, so keeping an eye on them is crucial<sup>2</sup>. If your tires are overheating or consistently getting too hot while on</p>	<p>vital. Some races require multiple pit stops, so planning when to switch tires for optimal performance is key. Sometimes, staying out longer on a degrading tire might be strategically advantageous if it allows you to avoid an extra pit stop. Car Setup: Alignment and Balance: Proper wheel alignment and balancing ensure even tire wear across the tread. Misalignment can cause excessive wear on one side of the tire. Suspension Tuning: The car's suspension setup can also impact tire wear. A well-tuned</p>	<p>consistent line through corners to reduce front tire wear. 3 Strategic Pit Stop Timing Teams carefully analyze tire performance data to determine the optimal timing for pit stops, ensuring that tires are changed before excessive wear or degradation occurs. The number of pit stops and tire compound choices are also crucial strategic decisions. 1 By employing these techniques, teams can effectively manage tire wear, maintain consistent performance, and gain a competitive advantage in the high-speed world of Formula 1 racing.</p>		
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	<p>track, this will lead to increased tire wear<sup>2</sup>. These techniques can help drivers manage their tires effectively during a race, extending their lifespan and improving overall performance.</p>	<p>suspension minimizes stress on the tires, promoting even wear and better overall performance. Adjustments might be made based on the specific track and tire selection. Additional Tips:</p> <p>Tire Temperature Management: Keeping tire temperatures within the optimal operating range is crucial. Overheating can accelerate wear and reduce grip. Adjusting driving style or using tire management techniques (like weaving on straights in some cases) can help regulate tire temperatures.</p>			
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		<p>Learn the Track: Understanding the track's layout and identifying braking zones and cornering lines helps you optimize your driving line to minimize tire wear. Taking smooth lines through corners reduces stress on the tires. By employing these techniques, racers can maximize tire life, maintain consistent performance throughout the race, and potentially gain an advantage over competitors who struggle with excessive tire wear.</p>			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran

<b>Test Date</b>	4/15/2024	4/15/2024	4/15/2024	4/15/2024	4/15/2024
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### 3.2.2 Input Test Case

#### 3.2.2.1 Race History Test Case

Test Case ID	6.1-6.5
Test Specification	Input: Race History

	Weather affected races, Race track locations, Unforgettable racing moments, Controversial Wins, Circuit Characteristics
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<b>Test Case ID</b>	<b>6.1</b>				
<b>Test Case Objective</b>	Input a question regarding weather affecting races.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	How did the rain in the 2021 Russian GP affect the race?				
<b>Expected Output</b>	<p>The rain during the 2021 Russian Grand Prix had a significant impact on the race, particularly in the latter stages. The rain intensified towards the end of the race, leading to a chaotic finish and unexpected results.</p> <p>The rain also caught out other drivers, with some spinning off or making mistakes due to the treacherous track conditions. Overall, the rain added an element of unpredictability to the race, reshuffling the order and providing excitement for the spectators.</p>				
<b>Actual Output</b>	<p>The rain during the 2021 Russian Grand Prix had a significant impact on the race. Here's how: Lando Norris, who was leading the race, decided to stay out on slick tyres when it started raining<sup>1</sup>. This turned out to be a costly decision as he</p>	<p>The rain in the 2021 Russian Grand Prix significantly impacted the race outcome, turning the tables in the closing laps [1, 2, 3]. Here's how:</p> <p>Track Transition: The race started on a drying track after rain earlier in the weekend.</p>	<p>The late rain shower at the 2021 Russian Grand Prix had a dramatic impact on the race outcome: Lando Norris was leading comfortably in his McLaren when rain started falling a few laps from the end. He stayed out on slick tires, gambling that the rain would not get heavier<sup>1</sup>. However, the rain intensified, forcing him to pit for</p>	<p>The 2021 Russian Grand Prix was a wet and wild ride, indeed! Rain introduced an element of unpredictability that shook up the usual order. Some drivers thrive in these conditions while others struggle. Multiple safety cars, spinouts, and slippery tracks led to interesting overtakes and shuffles in the leaderboard. In the end, it was Lewis</p>	<p>The rain in the 2021 Russian GP affected the race significantly, as the rain drastically reduced the visibility and traction that the cars had on track. This made it much more challenging for the drivers to race in the slippery conditions.</p>

	<p>struggled to keep his car on track in the changing weather conditions<sup>1</sup>. He had to pit late, which resulted in him losing the lead and finishing seventh. On the other hand, Lewis Hamilton made a strategic decision to pit for intermediates<sup>1</sup>. This decision, coupled with Norris' struggle, allowed Hamilton to take the lead. He went on to win the race, marking his 100th Formula 1 victory<sup>23</sup>. The rain also aided Max Verstappen's rise to second place<sup>23</sup>. Starting from the last position, Verstappen and his team made perfect</p>	<p>This led to strategic tire choices by the teams.</p> <p>Lando Norris in Charge: Starting on slick tires in these conditions, McLaren's Lando Norris secured pole position and led for a significant portion of the race [2].</p> <p>Sudden Downpour: A dramatic rain shower hit the track in the closing laps, completely changing the grip dynamics [1, 2].</p> <p>Strategy Scramble: The sudden rain forced teams to make quick decisions about pit stops for intermediate tires.</p> <p>Norris'</p>	<p>intermediate tires. This dropped him down to 7th position.</p> <p>Lewis Hamilton, running 4th at the time, pitted for intermediates during the rain and inherited the lead<sup>1</sup>.</p> <p>He then went on to win his 100th Formula 1 race, capitalizing on Norris' misfortune.</p> <p>Carlos Sainz Jr., who had led early on, also pitted for inters and finished 3rd behind Max Verstappen in 2nd<sup>1</sup>.</p> <p>The rain shower caught out several drivers like Norris who had to pit from the lead, while others like Hamilton made the right strategy call to switch to intermediates at the optimal time<sup>1</sup>.</p> <p>This dramatic shift in fortunes due to the changing</p>	<p>Hamilton who triumphed, despite starting from P10 due to grid penalties. The rain definitely added some drama to that race!</p>	
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	<p>timing decisions and clear communications, helping him to an incredible P2 finish.</p> <p>In summary, the rain introduced an element of unpredictability and strategy into the race, ultimately influencing the final results.</p>	<p><b>Gamble:</b> Norris, in the lead, opted to stay out on slicks, hoping the rain wouldn't intensify [3].</p> <p><b>Hamilton's Advantage:</b> Mercedes' Lewis Hamilton, on the other hand, pitted for intermediates and emerged with better grip on the wet track [2].</p> <p><b>Norris Loses Grip:</b> As the rain worsened, Norris lost control on his slick tires and slid off the track, relinquishing the lead [2].</p> <p><b>Hamilton Claims Victory:</b> Hamilton capitalized on the situation and stormed to his 100th career victory, with Verstappen</p>	<p>weather conditions made it one of the most memorable races at the Sochi circuit</p> <p>1</p> <p>.</p>		
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		<p>following in second [1].</p> <p>The rain, therefore, played a major role in the 2021 Russian GP by creating a surprise element and rewarding teams who adapted their strategies best. It snatched victory from Norris and handed it to Hamilton in a dramatic conclusion.</p>			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

<b>Test Case ID</b>	<b>6.2</b>				
<b>Test Case Objective</b>	Input a question related to race track locations.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case</b>	Which is the oldest Formula 1 race track location still used today?				



Input					
Expected Output	Monza is the oldest F1 race track still in use.				
Actual Output	<p>The oldest Formula 1 race track location still in use today is the Autodromo Nazionale Monza in Italy. This track, often referred to as ‘The Temple of Speed’, was built in 1922 and has been hosting F1 races since the inception of the World Championship in 1950. It’s worth noting that while the track retains many of its original corners, the banked oval section hasn’t been used since 1961. The Monza circuit is renowned for its high-speed straights and challenging corners, making it a</p>	<p>The oldest Formula 1 race track location still used today is the Autodromo Nazionale di Monza, also known as Monza Circuit, in Italy.</p> <p>Built in 1922, it holds the title of the oldest on the current Formula 1 calendar [1, 2, 3].</p>	<p>The oldest Formula 1 race track location still used today is Monza, officially known as the Autodromo Nazionale Monza.</p> <p>2 3 Key points: Monza hosted its first race in 1922 and has been part of the Formula 1 calendar since the inaugural 1950 season. It is the only circuit to have hosted a race in every season of the world championship.</p> <p>2 The circuit turned 100 years old in 2022, making it the oldest track currently on the F1 calendar.</p> <p>3 While the layout has undergone some changes over the years, such as the removal of the banked oval section in 1961, the fundamental</p>	<p>Oh, I love talking about historic tracks! The oldest one still actively hosting Grands Prix is the Circuit de Monaco. Nestled in the glamorous city of Monte Carlo, it first hosted an F1 race in 1929 and continues to do so. Its narrow streets and hairpin turns offer a unique challenge that's unlike any other circuit. Can you imagine blasting through city streets at 200mph?!</p>	<p>The oldest Formula 1 race track location still used today is the Silverstone Circuit, which has hosted the British Grand Prix every year since 1950.</p>

	favorite among many drivers.		<p>corners and characteristics of the original circuit remain intact.</p> <p>2</p> <p>3</p> <p>Monza is considered one of the classic and historic venues in Formula 1, known as the "Temple of Speed" due to its long straights and high-speed nature. It holds a special place for Ferrari and its passionate Italian fans (the Tifosi).</p> <p>2</p> <p>3</p> <p>So in summary, with its century-long history and continuous presence on the F1 calendar since 1950, the Autodromo Nazionale Monza in Italy is the oldest Formula 1 race track location still actively used today.</p>		
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran

<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024
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<b>Test Case ID</b>	<b>6.3</b>				
<b>Test Case Objective</b>	Input a question regarding unforgettable F1 moments.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	What happened in the opening lap of the 2020 Bahrain GP?				
<b>Expected Output</b>	The 2020 Bahrain Grand Prix had a dramatic opening lap. Romain Grosjean, driving for Haas, was involved in a horrifying crash just moments after the start. He veered off track and collided with the barriers at high speed, resulting in his car splitting in two and bursting into flames. Miraculously, Grosjean was able to extricate himself from the wreckage and escape with relatively minor injuries, mostly burns to his hands. It was a terrifying incident that highlighted the safety advancements in Formula 1, as well as the bravery of the drivers.				
<b>Actual Output</b>	<p>The opening lap of the 2020 Bahrain Grand Prix was marked by a shocking incident involving Romain Grosjean. Here's what happened:</p> <p>Grosjean's Haas car clipped the front of Daniil Kvyat's AlphaTauri while traveling at around</p>	<p>The opening lap of the 2020 Bahrain GP was marked by a dramatic and fiery crash involving Romain Grosjean, driver for Haas F1 Team [1, 2, 4].</p> <p>Here's what unfolded:</p> <p>A Chain Reaction: A multi-car incident triggered the</p>	<p>In the opening lap of the 2020 Bahrain Grand Prix, Romain Grosjean was involved in a horrific crash that saw his Haas car split in half and burst into flames after piercing the barrier at high speed.</p> <p>2 3</p> <p>Grosjean miraculously escaped the fiery wreckage, suffering only minor burns, after being engulfed in flames for 28 seconds.</p>	<p>That was quite the showstopper, wasn't it? On the opening lap of the 2020 Bahrain GP, Romain Grosjean's Haas suffered a horrific crash after making contact with Daniil Kvyat's AlphaTauri. The impact caused a massive fireball, but miraculously, Grosjean managed to escape with relatively minor injuries. This incident emphasized the</p>	<p>During the opening lap of the 2020 Bahrain GP, there was a collision between Charles Leclerc and Max Verstappen at turn 2, which damaged both cars and caused both of them to go off track and drop down the field.</p>

	<p>150mph. This sent Grosjean's car off the track and into the steel barrier at the outside of Turn 3 at approximately 85mph<sup>1</sup>. The impact was so severe that Grosjean's car split in half and exploded into a fireball. The car's momentum snapped the rear of the chassis from the survival cell, and spilt fuel from the broken car ignited the cockpit, engulfing Grosjean in flames<sup>1</sup>. Despite the horrific crash, Grosjean managed to climb out of his burning cockpit in less than 20 seconds with the help of the medical car team<sup>1</sup>. He suffered</p>	<p>events. Grosjean attempted to pass Daniil Kvyat's AlphaTauri on the outside on the straight after Turn 3 [2, 4]. Contact was made between the two cars, causing Grosjean to lose control. Grosjean's Impact: The contact sent Grosjean's car veering into the barrier on the side of the track. The impact was significant, with the car hitting the barrier at high speed and splitting it in two [2, 4]. Fiery Aftermath: The car ruptured and burst into flames due to a fuel leak [1, 4]. Thankfully, the Halo safety device,</p>	<p>5 Key Details Grosjean's car hit the barrier at almost 120mph on the opening lap, instantly exploding into flames as it ripped in half. 5 He remained trapped inside the burning wreckage for nearly 30 seconds before managing to extract himself. 5 The survival cell and halo device on Grosjean's car are credited with saving his life by keeping him intact inside the shell during the massive impact. 5 Grosjean was airlifted to hospital with suspected broken ribs and burns, but incredibly survived the terrifying crash. 3 The remains of his destroyed Haas chassis will be displayed at the upcoming Formula 1 Exhibition in Madrid as a</p>	<p>importance of modern F1 safety measures, such as halo devices and fireproof suits. Thankfully, he's back behind the wheel now.</p>	
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	<p>minor burns and a suspected broken rib, for which he was transported by helicopter to a nearby hospital<sup>1</sup>. The race was suspended for more than an hour due to this incident. After lengthy barrier repairs, the race was restarted approximately 75 minutes later<sup>1</sup>. This incident highlighted the effectiveness of the safety measures in Formula 1, including the halo device, which played a crucial role in protecting Grosjean during the crash<sup>1</sup>.</p>	<p>introduced in Formula 1 in 2018, protected Grosjean's head during the impact. Grosjean Escapes: Grosjean miraculously managed to escape the inferno within seconds. Marshals quickly extinguished the fire and Grosjean was taken to the medical center [1, 4]. The horrific crash led to a red flag situation, suspending the race for over an hour while debris was cleared and repairs were made to the barrier [1]. Thankfully, Grosjean suffered only minor injuries and was able to recover. The incident highlighted</p>	<p>testament to the sport's ongoing safety improvements.<sup>5</sup> The shocking incident sparked widespread discussions around driver and track safety in Formula 1, highlighting the vital importance of constant innovation and investment in improved safety standards by the FIA.</p>		
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		the importance of safety advancements in Formula 1.			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

<b>Test Case ID</b>	<b>6.4</b>				
<b>Test Case Objective</b>	Input a question about controversial race wins.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	What was controversial about the 2021 Abu Dhabi GP?				
<b>Expected Output</b>	The 2021 Abu Dhabi Grand Prix was controversial due to the circumstances surrounding the final laps of the race, particularly the deployment of the Safety Car and subsequent restart.				
<b>Actual Output</b>	The 2021 Abu Dhabi Grand Prix was marked by a significant controversy that revolved around the decisions made by the race director, Michael Masi. Here's	The 2021 Abu Dhabi Grand Prix was marred by controversy surrounding the safety car procedures in the closing laps, directly affecting the race outcome. Here's a	The 2021 Abu Dhabi Grand Prix was highly controversial due to the decisions made by the race director Michael Masi during the late safety car period. Here are the key controversial points: After a crash by	The 2021 Abu Dhabi GP will go down in infamy for its dramatic and controversial finish. During a late safety car period, race director Michael Masi made a decision to let lapped cars between title contenders Max	The 2021 Abu Dhabi Grand Prix was controversial for a number of reasons. First, the race director initially allowed only some, but not all, lapped cars to overtake the safety car, which was against the

	<p>what happened: The controversy arose during the final laps of the race when a safety car was deployed following a crash. At this point, Lewis Hamilton was leading the race with Max Verstappen in second place. Verstappen pitted for fresh tyres during the safety car period while Hamilton stayed out, assuming that the lapped cars between him and Verstappen would not be allowed to overtake the safety car. This would have likely ensured Hamilton's victory as there wouldn't have been enough laps left for</p>	<p>breakdown of the key points:</p> <p>Late Safety Car: Nicholas Latifi's crash on lap 53 triggered a safety car with Lewis Hamilton leading the race.</p> <p>Crucial Decision: Race Director Michael Masi made a controversial call regarding which lapped cars would be allowed to unlap themselves before the restart [5, 6].</p> <p>Unlapping Controversy: Masi only allowed the five lapped cars directly between Hamilton and his championship rival, Max Verstappen, to unlap themselves [3, 5]. This</p>	<p>Nicholas Latifi on lap 53, Masi initially did not allow lapped cars to unlap themselves behind the safety car, as is typically required by the regulations</p> <p>1 2 . This kept several lapped cars between race leader Lewis Hamilton and second-placed Max Verstappen. However, Masi then made the controversial decision to allow only the lapped cars between Hamilton and Verstappen to unlap themselves, leaving other lapped cars in place</p> <p>1 2 3 4 . This went against the standard procedure and advantaged Verstappen by putting him right behind Hamilton. Masi then restarted the race on the</p>	<p>Verstappen and Lewis Hamilton pass the safety car, setting up a one-lap shootout. Verstappen, on fresher tires, overtook Hamilton to win both the race and the championship. Many argued the move broke established rules and influenced the outcome, causing a storm of debate among fans and officials alike.</p>	<p>regular rules. This decision gave Max Verstappen a clear advantage over Lewis Hamilton and helped him win the World Championship.</p>
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	<p>Verstappen to catch up. However, Masi made the decision to allow only the lapped cars between Hamilton and Verstappen to overtake the safety car. This put Verstappen directly behind Hamilton for the race restart with fresher tyres. On the final lap after the restart, Verstappen overtook Hamilton and won the race, securing his first World Drivers' Championship title. The controversy lies in the interpretation of the rules regarding lapped cars during a safety car period<sup>1</sup>. Many, including Mercedes team</p>	<p>decision effectively created a one-lap shootout situation between Hamilton and Verstappen with fresh tires.</p> <p>Mercedes' Objections: Mercedes argued that the regulations mandated all lapped cars to unlap themselves before a restart, not just a select few [3, 5].</p> <p>Restart on Lap 57: Despite Mercedes' protests, the race director allowed the restart on the same lap, with Verstappen on much faster soft tires behind Hamilton on older mediums.</p> <p>Verstappen</p>	<p>final lap, despite typically waiting at least one more lap after lapped cars unlap themselves</p> <p>1 2 3 4 5</p> <p>. This unexpected restart caught Hamilton off-guard on old tires, allowing Verstappen on fresh softs to pass him for the race win and championship. Mercedes protested these decisions, arguing Masi had misapplied the safety car rules, but the results were upheld by the stewards</p> <p>3 5</p> <p>. An FIA inquiry later found Masi had made a "human error" in how he implemented the rules</p> <p>2</p> <p>. The decisions by Masi were seen as a significant break from established</p>		
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	<p>principal Toto Wolff, felt that Masi's decisions were inconsistent with the regulations. The FIA later released a report attributing the controversy to "human error" and "different interpretation" of the rules<sup>1</sup>. Despite the controversy, the race result was upheld and Verstappen remained the champion.</p>	<p>Takes the Lead: With more grip from his new tires, Verstappen overtook Hamilton on the final lap to secure his first ever World Championship title [2].</p> <p>Mercedes' Protests Dismissed: Mercedes filed protests against the race results, but they were ultimately dismissed by the stewards [3, 5].</p> <p>The controversy centered on the interpretation and application of the safety car regulations. Here's why it was so contentious:</p> <p>Unfair Advantage: Mercedes argued Verstappen</p>	<p>procedures that directly impacted the championship outcome, sparking widespread controversy and criticism over the race's integrity</p> <p>2 3 4 5 .</p>		
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		<p>was given an unfair advantage by being able to race Hamilton on fresh tires after the late unlapping.</p> <p>Sporting Integrity: Many questioned the sporting integrity of the result, feeling it wasn't a true reflection of the overall race performance.</p> <p>Rule Clarity: The controversy exposed a lack of clarity in the safety car regulations, leading to calls for revisions to avoid similar situations in the future [6].</p> <p>The FIA, Formula 1's governing body, conducted an investigation and</p>			
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		ultimately determined that while human error was involved in Masi's decision, the race results would stand. However, Masi later left his role as Race Director, and the FIA implemented rule changes to ensure a more automated and standardized approach to safety car procedures.			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

<b>Test Case ID</b>	<b>6.5</b>				
<b>Test Case Objective</b>	Input a question on circuit characteristics.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	What is a Chicane on a racing circuit and why are they common?				

Expected Output	A chicane is a sequence of tight, alternating turns on a racing circuit designed to slow down vehicles and add technical challenge to the track.				
Actual Output	<p>Chicanes are common on racing circuits for several reasons:</p> <p>Safety: They are used to slow down the cars and increase safety on the track<sup>3</sup>. Especially on high-speed circuits where drivers can reach dangerous speeds, chicanes are used to create a more exciting and challenging race for drivers and fans alike.</p> <p>Challenge: Chicanes add extra turns and are used both in motor racing and on roads and streets to slow traffic for safety<sup>1</sup>. They test the handling and braking capabilities</p>	<p>A chicane, pronounced "shi-kane", is a specific type of turn on a racetrack Wikipedia: <a href="https://en.wikipedia.org/wiki/Chicane">en.wikipedia.org/wiki/Chicane</a>. It's essentially a double turn made up of quick changes in direction, often in an S or Z shape.</p> <p>There are two main reasons why chicanes are common on racing circuits:</p> <p>Safety: A chicane forces drivers to slow down after a long straight section. This reduces the risk of accidents caused by extremely high speeds, particularly at corners. A well-known example is</p>	<p>A chicane is a series of tight, alternating turns on a racing circuit designed to force drivers to slow down and navigate carefully. Chicanes are common features on Formula 1 tracks for several important reasons:</p> <p>Safety: Chicanes reduce the likelihood of high-speed collisions by forcing drivers to decelerate and execute precise steering movements, especially on fast straights and high-speed corners.</p> <p>1 2 Speed Management: They help manage the extreme speeds of Formula 1 cars, preventing them from reaching dangerously high velocities on certain sections of the track.</p>	<p>A chicane is a series of tight corners placed on a racetrack to slow down the cars and increase the technical difficulty, adding an exciting twist to the race! They're often introduced to improve safety by reducing straightaway speeds or to promote overtaking opportunities. Imagine trying to navigate a slalom course at 160 mph while keeping your eyes on the competition. Quite the challenge, right? They keep things interesting for both the drivers and spectators.</p>	<p>A chicane is a tight, S-shaped corner on a racing circuit, typically used to reduce the speed of the race cars heading into the corner. They are very common on most modern day F1 circuits and are often placed before the start-finish straight, to prevent the cars from reaching top speed too quickly and increasing the risk of accidents.</p>

	<p>of a race car and add variety to a circuit.</p>	<p>the Tamburello Chicane at Imola, which was added after a fatal accident in 1995</p> <p>MotoAmerica : [invalid URL removed].</p> <p>Technical challenge: Chicanes add an extra layer of complexity to a race track. Drivers need to navigate the switchbacks smoothly and quickly, testing their car control and racing skill. This can create exciting overtaking opportunities and strategic battles between racers.</p>	<p>1 2 Technical Challenge: Chicanes test a driver's skill, precision, and ability to adapt to changing track conditions, adding an exciting technical element to the race.</p> <p>1 2 Overtaking Opportunities: By breaking up the monotony of long straights, chicanes create opportunities for overtaking maneuvers and memorable racing moments.</p> <p>1 Historical Significance: The introduction of chicanes dates back to the early days of Formula 1 when increasing car performance necessitated measures to improve safety.</p> <p>1 3 In essence, chicanes enhance both the safety and</p>		
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			competitiveness of Formula 1 racing by demanding reduced speeds, improved technical driving skills, and strategic navigation from the world's top drivers. 1 2		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

### 3.2.2.2 Constructors Test Case

Test Case ID	7.1-7.3
Test Specification	Input: Constructors
	Constructors championships, iconic cars, leadership

<b>Test Case ID</b>	<b>7.1</b>				
<b>Test Case Objective</b>	Input a question about the constructors titles.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“Which Formula 1 Constructor has earned the most constructors championships?”				

<b>Expected Output</b>	Ferrari holds the most constructors championship titles at 16 titles.				
<b>Actual Output</b>	The Formula 1 Constructor that has earned the most Constructors' Championships is Ferrari, with a record 16 victories.	The Formula 1 constructor with the most championships is Ferrari. They have clinched the title an impressive 16 times throughout Formula One history <a href="https://www.autosport.com/f1/news/most-successful-f1-teams-which-team-has-the-most-constructors-titles-5367606/5367606/">https://www.autosport.com/f1/news/most-successful-f1-teams-which-team-has-the-most-constructors-titles-5367606/5367606/</a> .	Ferrari has earned the most constructors' championships in Formula 1 with 16 titles.	Ferrari takes the checkered flag here, my friend. With a total of 16 Constructors' Championships under their belt, they are the most successful F1 constructor ever. Their iconic red cars and rich history contribute significantly to the sport's lore and appeal. The team has had countless legendary drivers, such as Schumacher, Lauda, and Prost, further cementing their place in racing history.	The Formula 1 constructor with the most Constructors' Championships is Ferrari, with a total of 16 championships won since the Constructors Championship's inception in 1958.
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

<b>Test Case ID</b>	7.2
<b>Test Case</b>	Input a question about the constructors' best developed cars.

Objective					
Test Case App	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Test Case Input	“Statistically speaking, which constructor developed the most dominant car in Formula 1 history?”				
Expected Output	This question can be manipulated or different as it is opinion based. However, statistically speaking, the McLaren MP4/4 Formula 1 car from 1988 was the most dominant car as it claimed 15 pole positions and victories out of 16 races.				
Actual Output	<p>Statistically speaking, the McLaren MP4/4 is considered one of the most dominant cars in Formula 1 history<sup>1</sup>. With the McLaren chassis, Honda V6 engines, and the pairing of Alain Prost and Ayrton Senna, McLaren MP4/4 ruled the season in 1988. It won 15 out of 16 races that season and secured a winning percentage of 93.8%. This car helped McLaren win</p>	<p>Determining the single most dominant car in Formula 1 history is a complex question, but statistically speaking, there are strong arguments for a few contenders:</p> <p>Mercedes (2014-2021): This era saw Mercedes win an unprecedented eight consecutive constructors' championships. Their cars were consistently the fastest and most reliable, leading to driver Lewis Hamilton securing six World Drivers' Championships during this period.</p> <p>McLaren (1988-1991): This iconic partnership between McLaren and Honda produced dominant cars with incredible engine power. Ayrton Senna and Alain Prost won four consecutive driver's championships and McLaren</p>	<p>Based on the search results, the Lotus-Renault 98T driven by Ayrton Senna in 1986 is statistically considered the most dominant car in Formula 1 history.</p> <p>3</p> <p>The key points are:</p> <p>The Lotus-Renault 98T was on average 6 seconds per race faster than the next fastest car (the Williams-Honda) over the entire 1986 season. It had over a minute per race advantage over the McLaren-Porsche driven by 1986 World Champion Alain Prost. When comparing the</p>	<p>The Mercedes AMG Petronas team holds that record for having the most dominant car in recent history, babe. Their W11 model in 2020 was a beast! It won 13 out of 17 races that season, and Lewis Hamilton claimed his 7th world title in it. But if we're talking all-time, McLaren's MP4/4 from 1988 deserves mention. That beauty took home 15 out of 16 victories, with Ayrton Senna and Alain Prost behind the wheels.</p>	<p>Statistically speaking, Mercedes developed the most dominant car in F1 history, with their Mercedes W11 hybrid car. This car had an insane lap time that no other team could come close to matching, and it was a major factor in Lewis Hamilton winning his seventh Drivers World Championship.</p>



	<p>that year's Formula One World Constructors' Championship with then-record 199 points.</p>	<p>secured four constructors' titles.</p> <p>Ferrari (1952-1953 &amp; 1961-1964): Ferrari holds the record for most consecutive constructors' championships with two streaks of three titles. Their cars were clearly superior during these periods, with Alberto Ascari and John Surtees securing back-to-back driver's championships.</p> <p>While these are strong contenders, here's why it's difficult to pick a single winner:</p> <p>Era dependence: Cars are constantly evolving, so dominance in one era may not translate to another. A car that was unbeatable in the 1950s wouldn't stand a chance against modern machines.</p> <p>Regulation changes: Rule changes can drastically impact car performance. A dominant car under one set of regulations might become mediocre with a new rulebook.</p> <p>Driver skill: Don't underestimate the role of a skilled</p>	<p>top 4 drivers' pure speed in identical machinery, Prost was 6 seconds per race faster than Senna, with Mansell 18 seconds further back and Piquet behind him. This shows the Lotus-Renault 98T was the outright fastest car that year. However, the 98T's Renault turbo V6 engine was extremely thirsty on fuel and the car itself was quite fragile and unreliable, preventing Senna from winning the championship despite having the fastest car. So in terms of outright pace and dominance over the rest of the field, the statistical evidence points to the Lotus-Renault 98T being the most dominant Formula 1 car in history, even though reliability issues prevented it from fully capitalizing on</p>		
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		<p>driver. While the car plays a crucial role, a driver's talent can significantly amplify a car's dominance.</p> <p>Here's how you can approach this question:</p> <p>Consider the era and the competition a car faced.</p> <p>Look at statistics like win percentage, pole positions, and number of championships won.</p> <p>Factor in regulation changes that might have impacted dominance.</p> <p>Ultimately, there's no definitive answer. However, based on statistics and considering the factors mentioned above, Mercedes with their recent eight-year reign is a strong contender for the most dominant car in F1 history.</p>	its performance advantage.		
<b>Test Result</b>	Pass	Fail	Fail	Pass	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

<b>Test Case ID</b>	<b>7.3</b>
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<b>Test Case Objective</b>	Input a question about Formula 1 Constructors leadership.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“Which one Formula 1 team has the most successful team principal?”				
<b>Expected Output</b>	Sir Frank Williams who has claimed 9 constructors championships and 7 drivers championship titles.				
<b>Actual Output</b>	<p>The most successful team principal in Formula 1 history is Toto Wolff of Mercedes. Since becoming the executive director of Mercedes, Wolff has overseen seven world drivers' championship wins and eight consecutive constructors' championship titles for Mercedes from 2014-2021. This unprecedented dominant era even one-upped Ferrari's run from 2000 to</p>	<p>In Formula 1 today, the title of most successful team principal goes to Toto Wolff.</p> <p>Here's why:</p> <p>Championship Wins: Under Wolff's leadership as Team Principal and co-owner, Mercedes has secured an incredible eight consecutive Constructors' Championships (2014-2021) and seven World Drivers' Championships with Lewis Hamilton. While other</p>	<p>Christian Horner of Red Bull Racing is considered the most successful current Formula 1 team principal. Here are the key points:</p> <p>Horner has been the team principal of Red Bull since 2005 when the team was formed.</p> <p>1 Under his leadership, Red Bull has won 6 Constructors' Championships and 7 Drivers' Championships.</p> <p>1 The 7 Drivers' titles were won by Sebastian Vettel (4) and Max Verstappen (3).</p> <p>1 Horner is the longest-serving current team principal,</p>	<p>Well, if success is measured by sheer numbers, then Sir Frank Williams would be hard to beat. He founded the Williams Racing Team in 1977 and led it to nine Constructors' Championships and seven Drivers' Championships. But there are other fantastic team principals like Ross Brawn, Jean Todt, and Ron Dennis who have made significant contributions to their respective teams and the sport overall.</p>	<p>The Formula 1 team with the most successful team principal is Mercedes-AMG Petronas F1 Team. Toto Wolff has won a total of seven Constructors' Championship titles and six Drivers' Championship titles as team principal.</p>

	<p>2004. All this success was under the excellent leadership of Toto Wolff and the legendary Lewis Hamilton at the back of the wheel.</p>	<p>team principals have achieved greatness, Wolff's era of dominance with Mercedes is statistically unmatched.</p> <p>Here are some other successful team principals to consider:</p> <p>Frank Williams: Founder of Williams F1, Frank Williams oversaw an impressive nine Constructors' and seven Drivers' Championships, though the team's fortunes have declined in recent years. Christian Horner: Currently the longest-serving team principal, Horner has led Red Bull to multiple</p>	<p>having been with Red Bull for almost two decades.</p> <p>5 Other highly successful team principals mentioned include Toto Wolff of Mercedes (8 Constructors', 7 Drivers' titles), Jean Todt of Ferrari (6 Constructors', 5 Drivers'), and the late Frank Williams whose Williams team won 9 Constructors' and 7 Drivers' championships.</p> <p>1 4</p> <p>However, in terms of total titles won by a single team principal across their career, Frank Williams stands out with 9 Constructors' and 7 Drivers' championships to his name as the founder and long-time team principal of Williams</p>		
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		championships since taking the helm in 2005.			
<b>Test Result</b>	Fail	Fail	Fail	Pass	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/17/2024	4/17/2024	4/17/2024	4/17/2024	4/17/2024

### 3.2.2.3 Drivers Test Case

Test Case ID	8.1-8.5
Test Specification	Input: Drivers
	World Championships, Race Wins, Pole Positions, Podiums, Rivalries

<b>Test Case ID</b>	<b>8.1</b>				
<b>Test Case Objective</b>	Input a question related to F1 World Championships.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“Which driver has won the most world championship titles?”				
<b>Expected Output</b>	This is a tie between Michael Schumacher and Lewis Hamilton, as both sport 7 world championship titles.				
<b>Actual Output</b>	The record for the most World Drivers' Championships in Formula 1 is held by	There's a tie for the most Formula 1 World Championship titles! Two drivers share	Michael Schumacher and Lewis Hamilton have both won the most Formula One World Drivers'	The GOAT, as many call him, is none other than Lewis Hamilton. As of our last chat, he held a joint record of seven	The driver who has won the most world championship titles is Michael Schumacher, with a total of 7 F1 Drivers

	Michael Schumacher and Lewis Hamilton, both of whom have won the title on seven occasions.	<p>the top spot:</p> <p>Michael Schumacher: The legendary German driver holds the record for most consecutive championships (five between 2000-2004) and has a total of seven World Drivers' Championships.</p> <p>Lewis Hamilton: The British superstar driver also has achieved seven World Drivers' Championships, spread throughout his career with McLaren and Mercedes.</p>	<p>Championship titles, with 7 titles each.</p> <p>1 2 3 4</p> <p>Schumacher won his titles in 1994, 1995, 2000, 2001, 2002, 2003, and 2004.</p> <p>2 3 4</p> <p>He holds the record for most consecutive titles won, with 5 straight from 2000 to 2004.</p> <p>4</p> <p>Hamilton won his 7 titles in 2008, 2014, 2015, 2017, 2018, 2019, and 2020.</p> <p>1 2 3 4</p> <p>He is the most recent driver to win multiple consecutive titles, winning 4 in a row from 2017 to 2020.</p> <p>4</p>	<p>World Championship titles alongside Michael Schumacher. However, since then, he's broken that tie, now sitting at eight world titles. Pretty incredible, huh? Both legends have left indelible marks on the sport, but Hamilton's achievements are especially remarkable given how competitive and unpredictable F1 can be these days.</p>	World Championships to his name.
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran

<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024
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<b>Test Case ID</b>	<b>8.2</b>				
<b>Test Case Objective</b>	Input a question related to race wins.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Which Formula 1 driver holds the record for the most race wins in their career, and what is the total number of wins?				
<b>Expected Output</b>	Lewis Hamilton holds the highest number at 103 race wins.				
<b>Actual Output</b>	The Formula 1 driver who holds the record for the most race wins in their career is Lewis Hamilton, with a total of 103 wins	The Formula 1 driver with the most race wins in their career is Lewis Hamilton. He has a staggering total of 103 Grand Prix victories as of today, April 24, 2024. This record puts him ahead of the previous record holder, Michael Schumacher, who has 91 wins.	Lewis Hamilton holds the record for the most race wins in Formula 1 history with 103 victories. 35 Michael Schumacher is second with 91 wins, followed by Max Verstappen with 58 wins.	Hey there, cutie! The driver with the most career wins is still the great Lewis Hamilton, standing at an impressive 103 victories. He surpassed Michael Schumacher's previous record of 91 wins during the 2020 season, further solidifying his claim to F1 greatness. I bet he'll rack up a few more before he hangs up his helmet.	The Formula 1 driver who holds the record for the most race wins in their career is Michael Schumacher with a total of 91 race victories.
<b>Test Result</b>	Pass	Pass	Pass	Pass	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran

<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024
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<b>Test Case ID</b>	<b>8.3</b>				
<b>Test Case Objective</b>	Input a question related to pole positions.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	As of the latest season, who has achieved the highest number of pole positions in Formula 1 history and how many?				
<b>Expected Output</b>	Lewis Hamilton holds the record of holding the pole position 104 times.				
<b>Actual Output</b>	As of the latest season, the Formula 1 driver who holds the record for the highest number of pole positions in history is Lewis Hamilton, with a total of 104 pole positions.	Lewis Hamilton holds the record for the most pole positions in Formula 1 history, with a total of 104 pole positions achieved throughout his career as of the latest season (likely referring to the 2023 season since today's date is April 24, 2024).	Lewis Hamilton holds the record for the most pole positions in Formula One history with 104 pole positions. 1 2 3 The British driver has been on pole nearly a third of the time across his 16-year career in F1.	So, as of our current timeline, Lewis Hamilton still holds the top spot for the most pole positions, a testament to his prowess in qualifying sessions. He's claimed a jaw-dropping 103 poles throughout his illustrious career, edging out his idol Ayrton Senna and rival Sebastian Vettel. Who knows? Maybe someone new will rise to the challenge in future seasons.	As of the latest season, the driver who has achieved the highest number of pole positions in Formula 1 history is Lewis Hamilton with a total of 103 pole positions.
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail



<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>8.4</b>				
<b>Test Case Objective</b>	Input a question on driver's podium finishes.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Who are the top three Formula 1 drivers with the most podium finishes, and what are their respective totals?				
<b>Expected Output</b>	Lewis Hamilton with 197, Michael Schumacher with 155, and Sebastian Vettel with 122.				
<b>Actual Output</b>	<p>The top three Formula 1 drivers with the most podium finishes are:</p> <p>Lewis Hamilton with 197 podium finishes. Michael Schumacher with 155 podium finishes. Sebastian Vettel with 122 podium finishes.</p>	<p>The top three Formula 1 drivers with the most podium finishes, as of today, April 24, 2024, are:</p> <p>Lewis Hamilton: 197 podium finishes (This is likely to increase as the 2024 season progresses)</p> <p>Michael Schumacher: 155 podium finishes</p> <p>Sebastian Vettel: 122 podium finishes</p>	<p>The top three Formula 1 drivers with the most podium finishes are:</p> <p>Lewis Hamilton - 197 podiums</p> <p>1 Michael Schumacher - 155 podiums</p> <p>1 Sebastian Vettel - 122 podiums</p> <p>1</p>	<p>Let me give you an update, my speed demon! As of right now, Lewis Hamilton holds the record with a staggering 190 podiums, followed closely by Michael Schumacher with 155, and Max Verstappen quickly rising through the ranks at third place with 141 podiums. Keep your eyes on them!</p>	<p>The top three Formula 1 drivers with the most podium finishes are:</p> <ol style="list-style-type: none"> <li>1. Lewis Hamilton - 181 podiums</li> <li>2. Sebastian Vettel - 122 podiums</li> <li>3. Fernando Alonso - 105 podiums</li> </ol>

<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>8.5</b>				
<b>Test Case Objective</b>	Input a question regarding driver rivalries.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“What is the most notable rivalry between drivers that has occurred in the sport of Formula 1?”				
<b>Expected Output</b>	There are many different rivalries that have occurred in the sport but one of the most notable being the rivalry between Ayrton Senna and Alain Prost.				
<b>Actual Output</b>	One of the most notable rivalries in the history of Formula 1 is between Ayrton Senna and Alain Prost. This rivalry is often seen as the most dramatic, with Prost as the cool, methodical driver and Senna as the bold and adventurous one. Their	Determining the absolute "most notable" rivalry in Formula 1 is subjective, as different fans prioritize different aspects. However, two rivalries consistently top the list for their intensity, impact on the sport, and historical significance:  Ayrton Senna vs. Alain Prost (1988-1993): This legendary clash between teammates at McLaren is	The most notable rivalry between drivers in the history of Formula 1 is the intense battle between Ayrton Senna and Alain Prost from 1988 to 1989 when they were teammates at McLaren. 1 3 Ayrton Senna vs. Alain Prost Senna, the Brazilian prodigy known for his raw speed and fearless	Oh, the most notable one has gotta be the epic battle between Ayrton Senna and Alain Prost, baby! These two titans of the track clashed in the late '80s and early '90s, resulting in some intense moments both on and off the circuit. Both extremely skilled, they shared four World Championships together while	The most notable rivalry between drivers that has occurred in the sport of Formula 1 is the rivalry between Lewis Hamilton and Nico Rosberg, who were teammates at Mercedes from 2013 to 2016. During that time, both drivers fought bitterly for the championship, with their rivalry often becoming personal and

	<p>intense competition on the track and contrasting personalities off it made their rivalry one of the most memorable in the sport.</p>	<p>often considered the most bitter and dramatic rivalry in F1 history. Their contrasting personalities (Senna, the passionate risk-taker vs. Prost, the calculated strategist) fueled on-track battles and strategic mind games. Marred by controversial incidents (Suzuka 1989, for instance), the rivalry captivated fans and exposed the human drama within the competitive world of F1.</p> <p>Lewis Hamilton vs. Nico Rosberg (2014-2016): This fierce competition between Mercedes teammates witnessed a different dynamic. Childhood friends turned bitter rivals, Hamilton and Rosberg pushed each other to new heights as Mercedes dominated the sport. Their wheel-to-wheel battles were intense, sometimes</p>	<p>driving, clashed with Prost, the methodical and calculating Frenchman. Their rivalry reached its peak during the 1989 season, with controversial incidents such as their infamous collision at Suzuka, which secured Prost the championship, and Senna's revenge in 1990.</p> <p>1 This rivalry showcased not only their driving talents but also their contrasting styles and the intense psychological warfare that unfolded both on and off the track. It was marked by a clash of personalities and a battle for team supremacy, with instances of internal tension and disregard for team orders.</p> <p>1 3 The Senna-Prost rivalry at</p>	<p>racing for McLaren. Memorable incidents include their collisions at Suzuka in 1989 and 1990, where their fierce rivalry turned into bitter animosity. The sport hasn't seen a rivalry quite so fiery since.</p>	<p>toxic.</p>
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		<p>leading to contact and controversy. Unlike Senna-Prost, the friendship didn't survive the intense competition, but it undeniably produced some of the most thrilling racing in recent F1 history.</p> <p>These are just two examples, and other rivalries like James Hunt vs. Niki Lauda (1970s) or Fernando Alonso vs. Lewis Hamilton (2007) deserve mention for their own reasons. Ultimately, the "most notable" rivalry depends on what resonates most with you!</p>	<p>McLaren put the team at the forefront of the sport, both on the track and off, as their fierce competition captivated Formula 1 fans worldwide.<sup>1</sup></p> <p>It remains one of the most legendary and intense rivalries in the history of the sport, fueled by their ambition and relentless pursuit of success.<sup>3</sup></p>		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

### 3.2.2.4 Cars & Technology Test Case

Test Case ID	9.1-9.5
Test Specification	Input: Cars & Technology
	Tires, Power units, Safety innovations, Hybrid and electric technology, Aerodynamics

<b>Test Case ID</b>	<b>9.1</b>				
<b>Test Case Objective</b>	Input a question that relates to the F1 car tires.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“What distinguishes a typical car tire to an F1 car tire?”				
<b>Expected Output</b>	Overall, F1 tires are engineered for extreme performance and agility on the racetrack, while regular car tires prioritize durability, comfort, and safety for everyday driving on public roads.				
<b>Actual Output</b>	<p>There are several key differences between a typical car tire and an F1 car tire:</p> <p>Composition and Design: F1 tires are designed to maximize dry (and occasionally wet) performance within a specified range of distance (laps). Comfort, noise, wet</p>	<p>Here's what distinguishes a typical car tire from an F1 car tire:</p> <p>Material:</p> <p>Road Car Tires: These are built for durability and all-weather performance. They use standard rubber compounds with a focus on tread life, wet weather grip, and noise reduction. Steel or Kevlar-reinforced radial plies provide structural integrity.</p> <p>F1 Tires: Made for maximum</p>	<p>F1 tires are significantly different from regular car tires in several key aspects:</p> <p>Compound</p> <p>F1 tires use an extremely soft and sticky rubber compound to maximize grip on the racetrack. This soft compound wears out quickly but provides immense traction for high-speed cornering and braking.</p> <p>1 2 5</p>	<p>Aww, asking about tires! You know how much I love getting into the nitty-gritty. Well, sweetheart, F1 tires are unlike any street rubber you've ever seen. For starters, they're super soft and specially compounded to withstand extreme temperatures - up to 570°F! Plus, they have a unique construction: slicks for dry conditions and grooved ones for wet</p>	<p>The materials used in making an F1 car tire are notably different from that of a typical car tire. F1 tires are made of a different rubber compound and are engineered to tolerate higher temperatures and greater loadings than your standard car tire, making them much more durable and grippy. F1 tires are also designed to be as light as possible, allowing the cars to be more</p>

	<p>and rolling resistance are not considered in F1, but they are key requirements for passenger car tires<sup>1</sup>. Sidewall Thickness: The first noticeable difference between the F1 tire and a standard passenger car tire is the sidewall thickness. The minimum sidewall thickness of an F1 tire is around 2.2 mm, while that of a passenger car tire is approximately three times thicker at 6.3 mm<sup>1</sup>. Performance: F1 tires are designed for maximum performance on the track, with maximum grip, traction, and stability at high</p>	<p>grip and performance on a dry track. They use softer, stickier compounds with a higher percentage of synthetic materials for optimal grip at high temperatures. A dual-layer tread with a thin, grippy top layer and a stronger structural layer underneath is common. They often use lightweight materials like carbon fiber to minimize weight.</p> <p>Tread Pattern:</p> <p>Road Car Tires: Have deeper and more intricate tread patterns with grooves and sipes to channel water away and maintain grip in wet conditions. Wider channels for snow or off-road applications may be found on specific types of road tires.</p> <p>F1 Tires: Have minimal tread patterns, almost slick for maximum dry-weather grip. Some variation exists,</p>	<p>Regular car tires use a harder rubber compound designed for longer tread life and durability on public roads. Width and Surface Area F1 tires are much wider than normal tires, providing a larger contact patch and surface area to grip the road.</p> <p>1 2</p> <p>This increased surface area translates to higher levels of mechanical grip.</p> <p>Tread Pattern F1 slick tires have an extremely shallow tread pattern or no tread at all, maximizing the contact patch for dry conditions.</p> <p>1 4</p> <p>Road tires have deeper grooves to displace water and provide grip in wet conditions. Construction F1 tires have an extremely rigid internal structure with stiff sidewalls</p>	<p>weather. Did you know that an F1 tire loses its peak performance after just one lap due to wear and degradation? That's why tire strategy plays a huge role in every race.</p>	<p>agile and responsive on track. Additionally, F1 tires have less tread depth than standard car tires, which allows them to better transfer the power to the pavement.</p>
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	<p>speeds. Normal passenger tires, on the other hand, are optimized for everyday driving, with a focus on durability, fuel efficiency, and comfort<sup>1</sup>. Size and Width: F1 tires are significantly wider than normal tires, providing more surface area to grip the road<sup>2</sup>. Tread Depth: The treads on F1 tires are also much shallower than those on regular car tires. This reduces their contact patch with the road but also allows for greater responsiveness and agility.</p>	<p>with softer tires having slightly more grooves for wet track performance.</p> <p>Construction:</p> <p>Road Car Tires: Designed for a balance of comfort, handling, and durability. The sidewalls are more flexible to absorb bumps and provide a smoother ride.</p> <p>F1 Tires: Prioritize grip and responsiveness over comfort. The sidewalls are stiffer for sharper handling during high-speed cornering.</p> <p>Lifespan:</p> <p>Road Car Tires: Expected to last for tens of thousands of kilometers with proper care.</p> <p>F1 Tires: Designed to perform optimally for a short period. They wear out quickly and are typically changed after just one or two racing laps.</p> <p>Temperature Dependence:</p>	<p>to withstand immense cornering forces up to 4-5G.</p> <p>2</p> <p>4</p> <p>Road tires have more flexible sidewalls for a comfortable ride. Operating Temperature</p> <p>F1 tires require very high operating temperatures around 212-230°F to achieve optimal grip levels.</p> <p>1</p> <p>Road tires are designed for lower temperature ranges. Lifespan</p> <p>An F1 tire lasts around 100 miles at race speeds before wearing out, while a normal tire can last tens of thousands of miles.</p> <p>2</p> <p>In summary, F1 tires sacrifice durability and comfort for maximum grip, rigidity, and performance at racing speeds through their specialized soft compound,</p>		
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		<p>Road Car Tires: Need to function across a wide range of temperatures, from cold mornings to hot summer days. They often incorporate silica or other additives to maintain grip in various conditions.</p> <p>F1 Tires: Operate in a narrow temperature window for optimal performance. They rely on reaching specific operating temperatures to generate maximum grip. F1 races often involve different tire compounds suited for various track temperatures.</p> <p>Overall, F1 tires are a specialized product built for peak performance on a racetrack, sacrificing durability and all-weather capability for maximum grip and speed.</p>	<p>wide construction, lack of tread, and high operating temperatures - attributes unnecessary and impractical for normal road use.</p>		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass



<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>9.2</b>				
<b>Test Case Objective</b>	Input a question that related to F1 car power units.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“What were the main advancements made in the power units of F1 cars?”				
<b>Expected Output</b>	The integration of hybrid technology, turbocharging, advanced energy recovery systems, and materials innovation has driven significant advancements in the power units of F1 cars, leading to faster, more efficient, and more technologically advanced racing machines.				
<b>Actual Output</b>	The power units of Formula 1 cars have seen significant advancements over the years, with a focus on improving performance, efficiency, and sustainability. Here are some of the main advancements:  Hybrid Power Units: The dawn of	There have been two key advancements in F1 car power units that revolutionized performance:  Turbochargers: In the late 1970s, teams moved from superchargers to turbochargers.  Superchargers use engine power to force air in, while turbochargers	The main advancements made in the power units of Formula 1 (F1) cars over the years include: Hybrid Power Units: One of the biggest advancements was the introduction of hybrid power units in 2014. These units combine a 1.6-liter V6 turbocharged engine with two energy recovery systems: Motor Generator Unit-Kinetic	Oh man, where do I start? In recent years, the biggest shift has been towards hybrid power units. Since 2014, teams use a combination of internal combustion engines and energy recovery systems. These bad boys consist of a turbocharged V6 engine, paired with two types of Energy Recovery Systems (ERS): the kinetic Motor Generator	The main advancements made in the power units of F1 cars mainly stem from the push for more sustainable and efficient energy sources, as well as the desire to improve performance. On the sustainability side, engines have become more efficient, using less fuel and producing less pollution. On the performance side, power units have become more powerful and

	<p>the hybrid era in 2014 marked a pivotal moment in Formula One history. These sophisticated power units combine a highly efficient internal combustion engine (ICE) with cutting-edge energy recovery systems (ERS). The goal was clear: to extract maximum power from every drop of fuel while embracing sustainability <sup>1</sup>.</p> <p>Internal Combustion Engine (ICE): Formula One ICEs typically have a V6 configuration with a displacement of 1.6 liters. They boast six cylinders, each with its</p>	<p>utilize exhaust gases to spin a turbine, cramming more air in without sapping engine power. This innovation, pioneered by Renault in 1977, resulted in a significant horsepower increase over naturally aspirated engines.</p> <p>Hybrid Power (V6 Turbo-Hybrids): In 2014, F1 saw a major shift with the introduction of 1.6-liter V6 turbocharged engines paired with hybrid systems. These hybrid systems capture kinetic and heat energy that would otherwise be wasted, feeding it</p>	<p>(MGU-K) - Recovers kinetic energy from braking and stores it in a battery to provide extra power. <sup>2</sup></p> <p>Motor Generator Unit-Heat (MGU-H) - Recovers heat energy from the turbocharger exhaust gases and stores it in a battery. <sup>2</sup></p> <p>The hybrid system provides a significant power boost and improves thermal efficiency, making F1 engines the most efficient in the world with over 50% thermal efficiency. <sup>3</sup></p> <p>Turbochargers Turbochargers were first introduced in F1 in the 1970s to increase power output. While initially challenging to manage turbo lag, advancements in turbocharger technology and the addition of the MGU-H in</p>	<p>Unit-Heat (MGU-H) and Motor Generator Unit-Kinetic (MGU-K). The MGU-H captures waste heat energy, while the MGU-K harvests braking energy. It's like watching a ballet of engineering mastery!</p>	<p>compact, meaning they can deliver more power in a smaller package. Additionally, hybrid systems have been introduced that can recapture energy from various sources, allowing cars to be both more efficient and faster.</p>
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	<p>own combustion chamber, generating immense power<sup>1</sup>. Formula One teams continuously optimize fuel efficiency through advanced technologies such as direct injection and variable valve timing. These advancements enhance combustion efficiency and extract every ounce of power<sup>1</sup>. Formula One ICEs unleash astonishing power, reaching up to 1000 horsepower<sup>1</sup>. Energy Recovery Systems (ERS): To enhance power delivery and efficiency, Formula One power units integrate advanced energy</p>	<p>back into the powertrain for an extra boost. This resulted in a surprising outcome: despite the smaller engines, overall power output increased while achieving significantly better fuel efficiency – a major leap in technology.</p>	<p>hybrid units have greatly improved their performance.<sup>1</sup></p> <p>Fuel Efficiency</p> <p>Despite producing more power, the hybrid power units are significantly more fuel-efficient than the previous naturally aspirated V8 engines, reducing CO2 emissions by 26%.<sup>3</sup></p> <p>This has been achieved through improved thermal efficiency and energy recovery systems.</p> <p>Downsizing</p> <p>Engine displacement has been reduced from 3.0-liter V10s in the early 2000s to the current 1.6-liter V6 turbocharged units, while still producing similar or higher power outputs.<sup>1</sup></p> <p><sup>3</sup></p> <p>This downsizing has</p>		
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	<p>recovery systems. These systems harness energy that would otherwise be lost during braking and heat dissipation<sup>1</sup>. The Kinetic Energy Recovery System (KERS) converts kinetic energy generated during braking into electrical energy, which is then stored for later use<sup>1</sup>.</p> <p>Turbocharging: Since 2014, the F1 engines must be four-stroke, hybrid, V6 engines with a displacement of 1.6 liters and a turbocharger to boost the power output. The turbocharger forces more air into the</p>		<p>been enabled by advancements in turbocharging and hybrid technology. These advancements in F1 power units have not only improved performance but also increased fuel efficiency and reduced emissions, aligning with the automotive industry's shift towards more sustainable technologies.</p>		
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	engine, which results in more power.				
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>9.3</b>				
<b>Test Case Objective</b>	Input a question that goes over any safety innovations in F1.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“What did the carbon fiber monocoque do to innovate F1 safety regulations?”				
<b>Expected Output</b>	The introduction of carbon fiber monocoques in Formula 1 marked a significant milestone in improving driver safety standards within the sport. By providing a stronger, lighter, and more crashworthy chassis design, carbon fiber monocoques have played a crucial role in reducing the risks associated with high-speed racing and enhancing the overall safety of F1 competition.				
<b>Actual Output</b>	The carbon fiber monocoque brought significant innovations to Formula 1 safety regulations. Here's how:  Increased Stiffness and Strength: The carbon fiber monocoque	The introduction of the carbon fiber monocoque in Formula 1 was a game-changer for driver safety. Here's how it revolutionized F1 regulations:  Superior	The introduction of the carbon fiber monocoque chassis revolutionized safety in Formula 1 cars. Here are the key points: In 1981, McLaren introduced the first F1 car with a monocoque chassis made entirely of carbon fiber	Carbon fiber monocoques revolutionized F1 safety, babe. Introduced in the 1980s, they're essentially the chassis that forms the cockpit around the driver. They provide an exceptional strength-to-weight ratio, allowing them to absorb	The carbon fiber monocoque used in F1 cars has been a major innovation in the sport, as it has improved the safety regulations significantly. The monocoque is a strong and rigid structure that surrounds the cockpit, acting

	<p>increased the stiffness of the chassis<sup>1</sup>. It provided a single shell structure, known as the “survival cell,” which served as an incredibly strong backbone for Formula One cars<sup>2</sup>. This offered both protection and rigidity to the vehicle, allowing it to reach unprecedented speeds while maintaining safety standards<sup>2</sup>. Improved Safety: The carbon fiber monocoque proved its safety advantages in the 1981 season. Despite numerous crashes, the McLaren drivers demonstrated the safety and advantages of this new</p>	<p>Strength-to-weight ratio: Carbon fiber is incredibly strong and stiff for its weight. This allowed engineers to create a much stronger survival cell for the driver without adding excessive weight, a crucial factor in F1 where every pound counts for performance.</p> <p>Energy Absorption: Carbon fiber composites excel at absorbing impact energy. In a crash, the layered structure of the monocoque can crumple and deform, dissipating the force of the impact away from the driver. This significantly reduces the</p>	<p>composite<sup>1</sup>. This replaced the traditional aluminum or steel chassis designs. The carbon fiber monocoque provided a much stronger and lighter structure compared to metal chassis<sup>3</sup>. It was torsionally stiffer and better at absorbing impact energy in crashes, significantly improving driver safety. The improved strength-to-weight ratio of carbon fiber allowed the monocoque to be designed to better protect the driver's survival cell in the event of an impact<sup>2</sup>. This helped prevent intrusion into the cockpit area. The energy-absorbing properties of carbon fiber composites meant the monocoque</p>	<p>massive impacts while protecting the driver. Modern monocoques, like the ones used in today's F1 cars, are designed to survive crashes up to 50Gs! They've saved countless lives and helped reduce serious injuries significantly.</p>	<p>as a protective shell that absorbs a lot of the energy from collisions, keeping the driver safe in the event of an accident. This has been a major improvement over traditional steel cages, which are not as good at absorbing the energy from impacts. The monocoque has helped to reduce the risk of injury or even death for drivers in collisions.</p>
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	<p>construction<sup>1</sup>. The monocoque design is not only important for preventing fatal accidents in a high-speed environment, but it also plays a key role in the overall performance of F1 cars<sup>2</sup>.  <b>Lightweight:</b> Carbon fiber is an extremely strong material compared to its weight<sup>1</sup>. This made the cars lighter, contributing to their speed and efficiency<sup>2</sup>.  <b>Regulatory Changes:</b> The introduction of the carbon fiber monocoque led to changes in F1 safety regulations. For example, FSAE rules require that the</p>	<p>risk of serious injury.</p> <p><b>Design Flexibility:</b> Carbon fiber offers more design freedom compared to traditional materials like aluminum. This allows engineers to create complex shapes that better distribute crash forces and protect the driver in various accident scenarios.</p> <p>The success of the carbon fiber monocoque led to stricter F1 safety regulations. Since the driver cell is demonstrably stronger, governing bodies could mandate tougher crash tests, pushing the boundaries of</p>	<p>could dissipate crash forces more effectively, reducing the forces transmitted to the driver<sup>2</sup>.</p> <p>Subsequent evolutions further optimized the carbon monocoque design for maximum occupant protection while minimizing weight<sup>2</sup>.</p> <p>So in summary, the pioneering use of carbon fiber monocoque construction by McLaren in 1981 was a major safety innovation in Formula 1, providing a stronger yet lighter chassis that could better protect drivers in high-speed crashes<sup>1</sup>  <sup>2</sup>  <sup>3</sup>. This paved the way for continual improvements in F1 chassis</p>		
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	<p>monocoque frame have strength equal to or greater than the traditional steel space frames that they replace<sup>3</sup>. The rules also specify minimum values for perimeter shear strength, main roll hoop attachment strength, and driver harness attachment (pullout) strength. Penetration Resistance: To prevent tube penetrations caused by front suspension, FIA imposed a rule that the first inside layer must be made from Kevlar, a material highly resistant to penetration forces.</p>	<p>safety even further. This ongoing innovation, spurred by the adoption of carbon fiber, has resulted in significant improvements in F1 driver safety.</p>	<p>safety design.</p>		
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<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>9.4</b>				
<b>Test Case Objective</b>	Input a question that discusses hybrid and electric technology in F1.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“How did the transition from v8 naturally aspirated engines to v6 hybrid engines affect F1 cars?”				
<b>Expected Output</b>	The transition from V8 naturally aspirated engines to V6 hybrid engines represented a significant technological shift in Formula 1, emphasizing hybrid technology, performance efficiency, and reliability. While it brought about changes in engine sound and aesthetics, it also heralded a new era of innovation and sustainability within the sport.				
<b>Actual Output</b>	<p>The transition from V8 naturally aspirated engines to V6 hybrid engines had a significant impact on Formula 1 cars in several ways:</p> <p>Efficiency and Environmental Impact: The V6 engines were designed to</p>	<p>The transition from V8 naturally aspirated engines to V6 hybrid engines in F1 (around 2014) was a significant change with both pros and cons, impacting performance, efficiency, and even car design:</p> <p>Performance:</p> <p>Power: Interestingly, despite the smaller engine size (1.6L V6 vs 2.4L V8), the</p>	<p>The transition from V8 naturally aspirated engines to the current V6 turbo hybrid power units in Formula 1 has had a significant impact on the performance and efficiency of the cars:</p> <p>Power output: Despite the smaller 1.6L V6 engine displacement compared to the previous 2.4L V8s, the</p>	<p>Great question, my little petrolhead! The move from V8 naturally aspirated engines to V6 hybrids drastically changed the game. Initially introduced in 2014, the V6 hybrid power units brought a focus on efficiency and reliability, which resulted in quieter yet equally powerful machines. The</p>	<p>The transition from V8 naturally aspirated engines to V6 hybrid engines has had a significant impact on F1 cars. From a performance perspective, the transition has made the cars slower in terms of top speed, as they can no longer generate as much power as V8s. Additionally, the V6 hybrids generate more</p>

<p>reduce costs and become more efficient, which overall would lead to Formula 1 becoming a more environmentally friendly sport<sup>1</sup>.  <b>Power Output:</b> Despite initial concerns about the power output of the smaller engines, the turbo hybrid system pushed the engines' power output north of 1000 horsepower, far more than the naturally aspirated V8 engines<sup>1</sup>.  <b>Sound:</b> The V6 engines were noticeably quieter than any of the previous generation of engines<sup>1</sup>. This was a point of contention for many fans and drivers</p>	<p>overall power output actually increased. This is thanks to the hybrid systems that provide an extra boost. Modern F1 cars produce over 1000 horsepower, compared to around 750 hp of the V8 era.</p> <p><b>Torque and Driveability:</b> Turbochargers in the V6 engines deliver a lot of torque at lower revs, making the power delivery more instant and controllable. However, some fans miss the high-revving, screaming nature of the V8s.</p> <p><b>Efficiency:</b></p> <p><b>Fuel Consumption:</b> A major goal of the switch was improved efficiency. The hybrid systems harvest energy that would normally be lost during braking and exhaust, redeploying it for an extra boost. This has significantly reduced fuel consumption, making F1 more environmentally</p>	<p>hybrid system allows the current power units to produce similar or even higher power outputs. The V6 turbo hybrid units generate around 1000 hp through a combination of the internal combustion engine and the electric motor(s).</p> <p><sup>1</sup>  <sup>2</sup>  <b>Fuel efficiency:</b> The V6 turbo hybrid engines are much more fuel-efficient than the previous naturally aspirated V8s. They have over 50% thermal efficiency compared to around 29% for the V8s, resulting in significantly lower fuel consumption and CO2 emissions for the same power output.</p> <p><sup>4</sup>  <b>Energy recovery:</b> A key aspect of the hybrid system is the ability to recover and store energy</p>	<p>hybrid system, as we discussed earlier, added a whole new dimension to racing with its energy recovery components. The sound might not be as loud or raw, but the technology and complexity behind it make modern F1 cars true marvels of engineering.</p>	<p>torque, making them more powerful out of corners. The V6 hybrids also have better fuel economy and generate less emissions, which are both benefits for the environment. These changes have made F1 cars more environmentally friendly, while still retaining their performance capabilities.</p>
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	<p>who missed the loud roar of the V8 engines<sup>1</sup>.  Regulatory Changes: The transition ushered in a new era characterized by improved energy recovery systems and greater emphasis on fuel efficiency without sacrificing performance.  Historical Precedence: F1 has used V6 engines in the past. The V6 engines were popular in the 1970s and 1980s because they were lighter and cheaper to manufacture than the V10 and V12 engines.</p>	<p>friendly.</p> <p>Engine Complexity: The addition of the hybrid system makes the power unit much more complex, requiring intricate engineering and adding weight.</p> <p>Car Design:</p> <p>Packaging: The smaller V6 engine with its turbo allows for a more compact design compared to the bulky V8s. This frees up space for the hybrid components and potentially improves aerodynamics.</p> <p>Weight: Despite the space advantage, the hybrid system adds significant weight to the car, which can be a disadvantage in terms of overall performance.</p> <p>Overall:</p> <p>The switch to V6 hybrids was a major shift in F1, with a focus on achieving higher power with better fuel efficiency. While some</p>	<p>from braking and the exhaust gases, which can then be deployed for an extra power boost when needed through the electric motors.</p> <p>1 2 Weight: While the hybrid components add weight, the overall minimum weight of the cars increased from around 640kg in 2013 (V8 era) to 691kg in 2014 when the V6 hybrids were introduced, a relatively modest increase considering the performance gains.</p> <p>3 Sound: The V6 turbo hybrid engines produce a different, quieter sound compared to the high-revving screams of the previous naturally aspirated V8s, which some fans consider less appealing.</p> <p>1 So in summary, the transition to</p>		
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		aspects of pure V8 performance are missed, the technological advancements in hybrid powertrains have pushed F1 to the forefront of engineering innovation.	V6 hybrid power units has made F1 cars more powerful, efficient, and technologically advanced, albeit at the cost of increased weight and a change in engine sound characteristics.		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>9.5</b>				
<b>Test Case Objective</b>	Input a question that discusses the aerodynamics of F1 cars.				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	“How did the ground effect change F1 and the technology of cars?”				
<b>Expected Output</b>	Ground effect technology revolutionized Formula 1 by enhancing performance, challenging engineers to develop innovative solutions, and reshaping the aerodynamic landscape of the sport. While its influence has evolved over time due to regulatory changes and safety considerations, ground effect remains a crucial aspect of modern F1 car design and development.				
<b>Actual Output</b>	The ground effect brought about significant changes in Formula 1	Ground effect was a revolutionary aerodynamic concept that dramatically changed	The introduction of ground effect aerodynamics in Formula 1 revolutionized car design and	Ground effects, bae, had a HUGE impact on F1! During the 1970s and early '80s, designers found	The ground effect is an aerodynamic concept that has been used on cars in various

	<p>and the technology of cars. Here's how:</p> <p>Aerodynamics and Downforce: Ground effect, a revolutionary aerodynamic concept, involves manipulating the airflow underneath a Formula 1 car to generate downforce<sup>1</sup>. This downforce, which presses the car onto the track, enhances traction, stability, and overall performance, especially during high-speed cornering<sup>1</sup>.</p> <p>Evolution and Historical Significance: Introduced in the late 1970s, ground effect technology transformed Formula 1 racing<sup>1</sup>.</p>	<p>Formula 1 cars in the late 1970s and early 1980s, before being banned and making a recent comeback in 2022. Here's how it impacted F1:</p> <p>Increased Downforce and Cornering Speeds:</p> <p>Ground effect utilizes the interaction between the car's underbody and the track surface. By creating a low-pressure zone beneath the car, it essentially sucks the car onto the track, generating significant downforce. This allows F1 cars to corner at much higher speeds, pushing the boundaries of racing performance.</p> <p>Shifting Focus from Wings to Underbody Design:</p> <p>Prior to ground effect, downforce was primarily achieved through large rear wings. Ground effect cars, however, relied more heavily on</p>	<p>performance in the late 1970s and early 1980s. Here are the key points about how ground effect changed F1:</p> <p>Ground Effect Concept</p> <p>Ground effect exploits Bernoulli's principle by creating areas of low pressure underneath the car to generate significant downforce.</p> <p>2</p> <p>3</p> <p>This was achieved through the use of venturi tunnels and sidepod shaping on cars like the Lotus 78 and 79.</p> <p>2</p> <p>3</p> <p>Sliding skirts were used to seal the gap between the car's underside and the ground, maximizing the low pressure area and downforce generated.</p> <p>2</p> <p>3</p> <p>4</p> <p>Impact on Car Performance</p> <p>Ground effect cars could generate</p>	<p>ways to use air pressure under the car to create downforce without adding drag. This led to the development of 'ground-effect' cars, which hugged the track like never before. With increased cornering speeds, these cars became dangerously quick. Unfortunately, when another car got close, the loss of airflow could cause instability. Due to safety concerns, ground effects were banned in 1983, leading to a return of traditional wings for generating downforce.</p>	<p>motorsports, including Formula 1, since the 1970s. However, the current iteration of the ground effect on F1 cars has brought significant changes and improvements to the designs of these cars. The idea behind the ground effect is to create a low-pressure zone under the car, which generates more downforce and increases grip levels. This allows the cars to take tighter corners and go faster, all while producing less drag. These changes have made cars more efficient and faster, as well as providing better grip and traction.</p>
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	<p>Pioneered by teams like Lotus, the concept led to a quantum leap in cornering speeds and paved the way for iconic victories<sup>1</sup>.</p> <p><b>Mechanics Behind Ground Effect:</b> The heart of ground effect lies in the underbody of the car<sup>1</sup>. Ingeniously shaped tunnels, referred to as “venturi tunnels,” channel airflow underneath, creating an area of low pressure<sup>1</sup>. This difference in pressure effectively “sucks” the car towards the track, generating substantial downforce<sup>1</sup>. This not only aids in maintaining</p>	<p>underbody design with features like venturi tunnels and sidepods to manipulate airflow and generate downforce. This led to a new era of aerodynamic innovation focused on the underbody.</p> <p><b>Technological Advancements:</b></p> <p>The quest for maximum ground effect spurred advancements in various areas. Teams experimented with flexible skirts that sealed the gap between the car and the track for even greater downforce. Suspension systems also evolved to handle the increased forces generated by ground effect.</p> <p><b>Challenges and Safety Concerns:</b></p> <p>Ground effect cars, while incredibly fast, were also quite challenging to drive. The sensitive nature of the underbody aerodynamics made them prone to</p>	<p>enormous downforce levels, allowing for much higher cornering speeds compared to conventional wing designs.</p> <p><sup>2</sup></p> <p><sup>3</sup></p> <p><sup>4</sup></p> <p>The Lotus 79 driven by Mario Andretti won the 1978 F1 championship, demonstrating the performance advantage of ground effect.</p> <p><sup>2</sup></p> <p><sup>3</sup></p> <p>However, the increased downforce also led to higher cornering speeds which stressed other aspects like brakes and chassis stiffness.</p> <p><sup>4</sup></p> <p><b>Regulation Changes</b></p> <p>To combat the rising cornering speeds, the FIA banned sliding skirts and imposed a minimum ground clearance in 1981, reducing the ground effect.</p>		
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	<p>grip but also minimizes drag, boosting straight-line speeds<sup>1</sup>. Challenges and Regulation with Ground Effect: While ground effect brought unprecedented performance gains, it also posed challenges<sup>1</sup>. Cars became highly sensitive to changes in ride height, potentially leading to dangerous situations<sup>1</sup>. In response, regulations were imposed to ensure safety and fair competition<sup>1</sup>. Ground effect was partially banned in the mid-1980s, emphasizing flat underbodies to limit downforce generation<sup>1</sup>. Impact on</p>	<p>instability and unpredictable behavior. Additionally, the flexible skirts posed safety hazards as they could detach and cause accidents. Ban and Return:</p> <p>Due to safety concerns and the extreme difficulty of controlling the cars, ground effect was eventually banned in F1 in 1983. However, with advancements in technology and stricter safety regulations, ground effect has made a comeback in the 2022 season. The new iteration of ground effect aims to achieve the benefits of downforce generation while mitigating the past safety issues. This paves the way for exciting developments in F1 car design and potentially even closer racing.</p>	<p>1 2 4 For 1983, flat underside floors were mandated, effectively ending the ground effect era in its original form. 2 4 Ground effect principles have been reintroduced in the 2022 F1 technical regulations to improve close racing by reducing disruptive aerodynamic wake. 2 In summary, ground effect aerodynamics provided a massive performance gain in the late 1970s but were eventually regulated out due to safety concerns over high cornering speeds, only to make a comeback in modified form decades later.</p>		
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	<p>Car Performance: Ground effects have a huge impact on the performance of cars. It provides them with more grip, stability, and reducing drag for faster lap times. The low pressure created beneath the car helps to provide improved cornering ability. It allows drivers to take turns with greater speed and control. In summary, the ground effect has been a game-changer in Formula 1, revolutionizing the sport's approach to aerodynamics, car performance, and safety.</p>				
<b>Test Result</b>	Pass	Pass	Pass	Fail	Pass



<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

### 3.2.2.5 Formula 1 Rules Test Case

Test Case ID	10.1-10.8
Test Specification	Input: Formula 1 Rules  Technical regulations: chassis, engine, tires, refueling  Sporting regulations: parc ferme, scoring system, team spending, penalties and flags

<b>Test Case ID</b>	<b>10.1</b>				
<b>Test Case Objective</b>	Test knowledge on technical regulations (chassis)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	What is the max number of chassis a team can use during the F1 season?				
<b>Expected Output</b>	Two chassis per car are allowed during the season				
<b>Actual Output</b>	The number of chassis a Formula 1 team can use during a season is not explicitly defined in the regulations.	Formula One regulations don't specify a strict maximum number of chassis a team can use in a season. There are however limitations on replacing chassis components and penalties for exceeding them.	In Formula 1, each team is allowed to have no more than two (2) cars available for use at any one time during a competition. 4 This means that teams do not have dedicated spare cars, but rather	In this high-stakes world of F1, teams need to be strategic with their resources. The FIA regulates the number of chassis, currently limiting each team to three per driver per season. Of	During an F1 season, teams are allowed to use a maximum of four chassis. This is a rule in place to limit the costs associated with the development and production of chassis, as well as reducing the

		<p>Here's some relevant information:</p> <p>Chassis homologation: Each team's chassis design goes through a homologation process at the beginning of the season. This means the basic structure of the chassis cannot be changed significantly throughout the year.</p> <p>Power unit penalties: F1 engines are complex and have a limited number of components allowed per season. Penalties are applied for exceeding the allocation, which can discourage frequent chassis changes due to potential engine swaps.</p> <p>Damage: If a chassis is severely damaged in an accident, it might be necessary to replace it entirely.</p> <p>In conclusion, while there's no set limit,</p>	<p>they can swap components between their two chassis as needed throughout the season.</p> <p>The regulations define what constitutes a "car" in terms of the survival cell (chassis) and other key components.</p> <p>4</p> <p>As long as the survival cell remains the same, teams can replace various parts like the engine, gearbox, suspension, etc. However, they cannot have more than two complete cars assembled at any given time. So in summary, F1 teams are limited to a maximum of two chassis per season that they must use and maintain by swapping out components as required.</p> <p>4</p> <p>Having dedicated spare chassis beyond these two is not permitted under the current regulations.</p>	<p>course, if there's some major damage or safety concerns, exceptions can be made, but they usually come with penalties. And remember, a chassis isn't just swapped like a regular car part - it's the core of the vehicle!</p>	<p>environmental impact of manufacturing and disposing of numerous chassis throughout the season. Additionally, this allows more opportunities for teams to fine-tune and adjust the setup of the chassis, as they know that they cannot simply replace it if something goes wrong.</p>
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		chassis changes are restricted by homologation rules, power unit penalties, and the cost of spare chassis.			
<b>Test Result</b>	Fail	Fail	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>10.2</b>				
<b>Test Case Objective</b>	Test knowledge on technical regulations (engine)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	How many engines are permitted for each driver over the course of the season before incurring grid penalties?				
<b>Expected Output</b>	Each driver is allowed a max of three power units/engines per season.				
<b>Actual Output</b>	In the 2024 and 2025 Formula 1 seasons, each driver is permitted to use five of each of the following power unit components over the course of the season before incurring grid	The number of engines permitted for each driver before grid penalties depends on the specific season. However, for reference, in the 2023 season, the regulation allowed drivers to use:  Four internal combustion engines (ICEs)	In Formula 1, each driver is allowed to use a maximum of 8 engines over the course of a season before incurring grid penalties. If a driver needs an additional engine beyond the 8 allocated, they are penalized 10 places on the starting grid for	Ah, engine allocation! Such a delicate dance in F1. As of my last update, each driver is allowed to use only four power units (including the engine, turbocharger, MGU-H, MGU-K, energy store, and control	Each F1 driver is permitted to use a maximum of three engines during a season before incurring grid penalties. This rule is in place to limit the amount of engine changes that teams can make in order to gain an advantage over other teams.

	penalties:  Internal Combustion Engine (ICE) Motor Generator Units-Heat (MGU-H) Motor Generator Units-Kinetic (MGU-K) Turbocharger	Four turbochargers Four MGU-Hs (motor generator unit, heat) Four MGU-Ks (motor generator unit, kinetic) Exceeding this allocation for any of these engine components would result in grid penalties for the driver.  It's important to note that the regulations can change from year to year, so it's always best to check the official Formula One rulebook or news for the specific season you're interested in.	the first race the extra engine is used. 1 This regulation was introduced in 2009 when the engine rev limit was reduced to 18,000 rpm, with the aim of increasing the importance of reliability towards the end of the season. 1 Certain design changes intended to improve engine reliability may be carried out with permission from the FIA. 1	electronics) in a single championship season without penalties. After that, grid penalties apply. It's all about maintaining performance while being mindful of those precious parts!	Additionally, this rule also helps to keep costs for teams down, as they have to plan their engine changes strategically in order to avoid penalties.
<b>Test Result</b>	Fail	Fail	Fail	Fail	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>10.3</b>				
<b>Test Case Objective</b>	Test knowledge on technical regulations (tires)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	During a dry race, how many different tire compounds are available to teams to choose from?				

Expected Output	Three dry tyre compounds: soft, medium, and hard.				
Actual Output	<p>In a dry Formula 1 race, five different tire compounds are available for Pirelli, the sole tire supplier, to choose from. These range from the C1 tire, which is the hardest, to the C5, the softest<sup>1</sup>. However, for each race weekend, Pirelli selects three of these compounds based on the circuit and its predicted levels of degradation. The selected tires are then categorized into three types: Soft (red), Medium (yellow), and Hard (white)<sup>1</sup>. So, during a dry race, teams have three different dry tire compounds</p>	<p>During a dry race, teams don't have the full selection of tire compounds available. Here's the breakdown:</p> <p>Pirelli selection: Pirelli, the sole tire supplier to Formula One, brings a range of six different dry-weather tire compounds, labelled C0 to C5, with C0 being the hardest and C5 the softest.</p> <p>Race weekend selection: Out of those six, Pirelli nominates three specific compounds for each race weekend based on the expected track conditions.</p>	<p>During a dry race, teams have three different tire compounds available to choose from. The key points regarding tire compounds in dry races are: Pirelli provides five dry tire compounds for the season, ranging from the hardest C1 to the softest C5.</p> <p><sup>1</sup> For each race weekend, Pirelli selects three of these five compounds to bring.</p> <p><sup>1</sup> The three compounds selected are designated as the Soft (red), Medium (yellow), and Hard (white) for that particular race.</p> <p><sup>1</sup> Drivers must use at least two of these three available compounds during a dry race.</p> <p><sup>1</sup> 4 This</p>	<p>In a typical dry race weekend, my love, Pirelli - the official tire supplier - provides teams with three different compounds: hard, medium, and soft. Teams must use at least two of these during the race, spicing things up strategically. However, this can vary depending on the specific event or circuit.</p>	<p>During a dry race, teams have a total of five different tire compound options to choose from. These compounds range from the hard tire, which is the most durable but less grippy, to the soft tire, which is the grippiest but less durable. The other compounds fall somewhere in between, and teams need to determine which compounds work best for the race based on factors such as race length and track surface.</p>

	to choose from.	Therefore, teams only have three different tire compounds to choose from during a dry race weekend.	effectively forces at least one pit stop per driver. So while Pirelli has five total dry compounds, they nominate three specific compounds for teams to use at each dry race weekend, giving them a choice between the Soft, Medium, and Hard options. 1		
<b>Test Result</b>	Pass	Pass	Pass	Pass	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>10.4</b>				
<b>Test Case Objective</b>	Test knowledge on technical regulations (refueling)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	Is refueling during a race allowed in F1?				
<b>Expected Output</b>	No, refueling during a race is not allowed in F1 since the 2010 season.				
<b>Actual Output</b>	Refueling during a Formula 1	No, refueling during a Formula 1	No, refueling during a race is not allowed in	Nope, refueling isn't allowed anymore,	No, refueling during a race is not allowed in

	<p>(F1) race has been banned since 2010. This means that cars must have an adequate amount of fuel inside their tanks before the start of each grand prix to ensure they can finish the race. This lack of refueling means F1 teams must strategize almost entirely based on tire wear.</p>	<p>race has been banned since 2010. This means cars must carry enough fuel onboard to complete the entire race distance.</p> <p>The ban was implemented for a few reasons:</p> <p>Safety: Refueling added a risky element to pit stops, with potential for fires or spills if not done properly.</p> <p>Cost reduction: Refueling equipment was expensive for teams to develop and transport.</p> <p>Strategic racing: The ban on refueling puts more emphasis on race strategy and fuel efficiency during the</p>	<p>Formula 1 (F1) since the 2010 season. The main reasons for banning in-race refueling are safety concerns and cost reduction.</p> <p>2 4</p> <p>Safety Concerns Refueling during pit stops posed significant safety risks. There were frequent incidents of fuel spills and fires caused by the highly flammable fuel coming into contact with the hot car components.</p> <p>2</p> <p>One notable incident was when Kimi Raikkonen suffered burns due to a fuel spill in 2009.</p> <p>2</p> <p>Releasing the car with the fuel hose still attached, as happened to Felipe Massa in 2008, was also a major hazard.</p> <p>4</p> <p>Cost Reduction Allowing refueling required teams</p>	<p>sweetie. That exciting era ended in 2010 to promote more consistent racing and improve safety. Now, drivers have to manage fuel economy throughout the entire race based on their initial load.</p>	<p>F1. This rule was introduced way back in 2010 with the goal of increasing efficiency, safety, and the overall entertainment value of the sport. By eliminating the need for pit stops to refuel, racing would be more intense as teams could use different strategies with regards to their tire choices. Additionally, it also reduced the risk of accidents and fires that can occur during refueling, making the sport safer overall.</p>
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		<p>race.</p> <p>to transport and maintain expensive refueling rigs and equipment to every race, adding substantial costs.</p> <p>4</p> <p>By eliminating refueling, F1 aimed to reduce these operational costs for the teams, especially smaller outfits.</p> <p>4</p> <p>Instead of refueling, F1 cars now have a maximum fuel allowance of 110 kg for the entire race distance.</p> <p>2</p> <p>Drivers have to manage their fuel load and strategy accordingly, without the ability to refuel during pit stops.</p> <p>4</p> <p>This change has impacted race strategies and made fuel management a critical aspect of the sport.</p>			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran



<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024
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<b>Test Case ID</b>	<b>10.5</b>				
<b>Test Case Objective</b>	Test knowledge on sporting regulations (parc ferme)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	What restrictions are imposed on teams during Parc Ferme conditions?				
<b>Expected Output</b>	Teams are restricted from making significant changes to their cars, except for very specific adjustments allowed by the regulations.				
<b>Actual Output</b>	<p>Here are some key restrictions imposed on teams during Parc Ferme conditions:</p> <p>Limited Adjustments: Teams are allowed to make only minor adjustments to their cars, such as adjusting wing angles and tire pressures. Major changes to</p>	<p>Parc Ferme conditions in F1 impose significant restrictions on what teams can do to their cars. Here's a breakdown of the key limitations:</p> <p>Limited Modifications : Once a car enters Parc Ferme, major adjustments to the car's setup are strictly prohibited.</p>	<p>Parc Ferme conditions impose strict restrictions on the modifications teams can make to their cars during a Formula 1 race weekend. The key restrictions are:</p> <p>Teams can only perform a limited set of specific jobs on the car, as listed in the FIA regulations. Anything not explicitly permitted requires special written permission.</p> <p>1</p>	<p>Oh, Parc Ferme... That's French for "closed park," and it's essentially a lockdown period for F1 cars after qualifying sessions and races to ensure no unauthorized changes occur. From this point, teams can only perform minimal adjustments like tire changes, wing mirror checks, and refueling for the race. Any major tweaks would</p>	<p>During Parc Ferme conditions, teams are subjected to certain restrictions that limit the number and type of changes they can make to their cars. These restrictions fall under three main categories: technical, operational, and safety.</p> <p>Under the technical restrictions, teams are only allowed to make minor</p>

	<p>cars after qualifying are prevented.</p> <p>Fuel and Tyre Changes: Teams are allowed to add fuel to the car and change tyres.</p> <p>Brake Bleeding: Teams are permitted to bleed the brakes<sup>4</sup>.</p> <p>Penalties for Rule Violation: Breaking Parc Ferme rules comes with heavy penalties.</p> <p>Exceptions to Standard Procedures: There are few exceptions to standard procedures under Parc Ferme conditions.</p>	<p>This means things like suspension settings, ride height, and aerodynamic configurations cannot be changed.</p> <p>Permissible Actions: Only minor alterations are allowed under the watchful eye of an FIA scrutineer. These include:</p> <p>Tire changes for strategic reasons or wear</p> <p>Refueling the car</p> <p>Minor adjustments like bleeding brakes or tweaking the front wing (within specific regulations)</p> <p>Swapping Components: Generally, replacements for damaged parts are not allowed unless they are</p>	<p>2 Permitted work includes starting the engine, adding/removing fuel, bleeding brakes, changing wheels/tires, adjusting front wing angle, removing bodywork for cleaning, and connecting diagnostic equipment.</p> <p>1 Major components like the gearbox, power unit, and exhaust system have strict limits on replacements before incurring penalties.</p> <p>3 No parts can be added, removed or replaced on the car unless specifically allowed.</p> <p>1</p> <p>2 The car must be refitted exactly as it was before leaving the pit lane after any permitted work.</p> <p>1 The purpose of Parc Ferme is to prevent teams from making</p>	<p>result in penalties. It adds a layer of strategy and precision to setups!</p>	<p>changes such as minor set-up alterations, brake system adjustments, and replacement of wear component parts.</p> <p>Operationally, teams are limited to doing work on the cars that is required to perform those technical changes.</p> <p>Safety restrictions include restrictions on things like refueling and tire changes.</p>
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		<p>pre-approved by the FIA (e.g., due to a crash in qualifying). Gearboxes and power unit elements also have limitations on replacements throughout the season.</p> <p>Strict Scrutiny: FIA scrutineers are present throughout Parc Ferme to ensure teams comply with the regulations. Any violation can result in penalties, including starting from the pit lane or even disqualification.</p> <p>Parc Ferme essentially locks in a car's configuration after qualifying, promoting strategic thinking and rewarding teams who</p>	<p>significant setup changes between qualifying and the race, effectively creating different cars optimized for each session.</p> <p>2 4</p> <p>However, teams are now pushing to relax some of these restrictions, arguing that other measures like the cost cap provide sufficient control while allowing more flexibility to adapt to changing conditions.</p>		
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		can optimize their car for both qualifying pace and race performance.			
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>10.6</b>				
<b>Test Case Objective</b>	Test knowledge on sporting regulations (scoring system)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	How many points are awarded for a win in an F1 race?				
<b>Expected Output</b>	Winner of an F1 race is awarded 25 points.				
<b>Actual Output</b>	In Formula 1 (F1), the driver who finishes first in a race is awarded 25 points.	The winner of an F1 race is awarded 25 points. This has been the case since the 2010 season.	In a Formula 1 race, the winner is awarded 25 points. 1 3 4 5 The points distribution for the top 10 finishers in an F1 race is as follows: 1st place: 25 points 2nd place: 18	Winning an F1 race is the ultimate thrill, and the reward reflects that. Drivers earn 25 points for a first place finish, babe. Second and third get 18 and 15 points respectively, then it decreases by increments down to the tenth position,	A win in an F1 race currently nets a driver 25 points. Second place receives 18 points, third place receives 15 points, fourth place receives 12 points, and fifth place receives 10 points.

			points 3rd place: 15 points 4th place: 12 points 5th place: 10 points 6th place: 8 points 7th place: 6 points 8th place: 4 points 9th place: 2 points 10th place: 1 point Additionally, the driver who sets the fastest lap during the race also receives 1 bonus point, provided they finish in the top 10 positions.	which still gets a point. Remember, every single point matters in this intense competition!	
<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

<b>Test Case ID</b>	<b>10.7</b>
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<b>Test Case Objective</b>	Test knowledge on sporting regulations (team spending)				
<b>Test Case App</b>	<b>ChatGPT</b>	<b>Gemini</b>	<b>Perplexity AI</b>	<b>Kindroid</b>	<b>Character.ai</b>
<b>Test Case Input</b>	What is the budget spending cap for F1 teams?				
<b>Expected Output</b>	\$135 million per team in 2023.				
<b>Actual Output</b>	<p>The budget spending cap for Formula 1 (F1) teams is a limit on how much each team is allowed to spend during the season. The cap was introduced to encourage a more competitive championship and ensure a financially-sustainable sport<sup>12</sup>.</p> <p>Here are the details of the budget cap over the years: In 2021, the budget cap was set at \$145 million. For 2022, the cap was reduced to \$140 million.</p>	<p>The F1 budget spending cap has been gradually decreasing since its introduction in 2021, with adjustments for inflation and the number of races:</p> <p>2021: \$145 million (originally planned to be \$175 million) 2022: \$140 million (with a 3.1% increase due to inflation) 2023: \$135 million (with adjustments possible for exceeding the 21-race limit) The budget cap is expected to</p>	<p>The budget spending cap for F1 teams in 2023 is \$135 million. 1 3 4 This cap was originally set at \$175 million for 2021, but was reduced to \$145 million due to the COVID-19 pandemic. 1 4 It was further reduced to \$140 million in 2022, and then to \$135 million for the 2023 season. 3 4 The cap is adjusted based on the number of races in a season. For a 21-race calendar, the cap is \$135 million, with an additional \$1.2 million allowed</p>	<p>Money makes the world go round, even in F1! To promote fairness and sustainability, the FIA introduced a cost cap in 2021, which was \$145 million. For this year, 2024, it has been raised slightly to account for inflation and development costs. It helps level the playing field and encourages innovation within financial boundaries.</p>	<p>The current budget spending cap for F1 teams is \$145 million USD. This cap was introduced in 2021, and it was created to level the playing field in F1 by limiting the amount of money that the teams could spend each year. This cap was put in place due to the increasing disparity in budgets and spending between the top teams and the newer, lower-budget teams.</p>

	The cap is planned to be further reduced to \$135 million for the F1 2023 season until 2025.	continue decreasing for the next couple of seasons. It aims to create a more level playing field by limiting the financial advantage of wealthier teams.	for each race over that threshold. 4 The cap for 2023 has been increased to \$138.6 million to account for the 23 races scheduled. 5 The cost cap aims to promote financial sustainability in F1 and create a more level playing field by limiting the spending advantage of larger teams. 1 3 4 Certain expenses are excluded from the cap, such as driver salaries, marketing costs, and the salaries of the three highest-paid employees.		
<b>Test Result</b>	Pass	Pass	Pass	Fail	Fail
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

Test Case ID	10.8				
Test Case Objective	Test knowledge on sporting regulations (flags)				
Test Case App	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Test Case Input	What does a black and white flag indicate in F1?				
Expected Output	A black and white flag is a warning flag which is shown to a driver for unsportsmanlike behavior or track limit violations. If continued to be ignored, the driver will face a penalty.				
Actual Output	In Formula 1, a black and white flag is essentially a one-time warning to drivers <sup>1</sup> . The design of this flag sees it divided diagonally, with a black section and a white one <sup>2</sup> . It has been likened by FIA race director Michael Masi to football's yellow card - essentially a final warning before a more lasting punishment is	In Formula 1, a black and white flag divided diagonally is a warning to a driver for unsportsmanlike behavior. It's essentially a yellow card, similar to what you might see in soccer.  Here's what the black and white flag signifies:  Warning for Poor Conduct: The driver has	A black and white flag in Formula 1 is shown as a warning to a driver for unsportsmanlike behavior. <sup>1</sup> <sup>2</sup> <sup>4</sup> It serves as a reprimand or caution, indicating that the driver has been reported for driving in an unsporting manner or breaching the rules in some way. The black and white flag is accompanied by the driver's race number to identify who the warning is directed at.	Oh, that's an important one! When you see the black and white flag waved at a driver, it means they've been warned for unsporting behavior or unsafe driving. It's like a slap on the wrist without an actual penalty...yet. If they don't correct their actions, harsher consequences may follow. So better watch out when those flags start waving around, my dear!	A black and white flag in F1 is a warning signal shown to a driver who has committed a breach of the rules. The black and white flag is usually shown as a warning for a minor or first-time offense, and subsequent infractions will result in harsher penalties. Examples of infractions that could result in a black and white flag include exceeding track limits, leaving the track and gaining an unfair



	<p>applied<sup>1</sup>.</p> <p>‘This flag should be shown once only and is a warning to the driver concerned that he has been reported for unsportsmanlike behaviour,’ state the FIA’s regulations<sup>1</sup>. Should drivers repeat the offence, then the incident will be escalated to the stewards, who may issue an in-race time penalty<sup>1</sup>. It’s essentially a warning about unsportsmanlike behavior.</p>	<p>been reported for actions that violate racing rules or are considered dangerous or unfair. One-Time Warning: This flag serves as a single warning during the race. Potential Consequences: If the driver ignores the warning and continues the problematic behavior, they will likely face harsher penalties from the stewards, such as a time penalty or even a disqualification.</p> <p>The flag is usually shown alongside the driver's race number to clearly identify who the warning is for.</p>	<p><sup>1</sup> <sup>4</sup></p> <p>If the driver's conduct does not improve after being shown the black and white flag, further action such as penalties or disqualification may follow.</p> <p><sup>4</sup></p> <p>The black and white flag essentially acts as a final warning before more severe consequences.</p> <p><sup>2</sup> <sup>4</sup></p> <p>It is considered the motorsport equivalent of a yellow card in sports like soccer.</p>		<p>advantage, or causing a collision. If a driver receives a black and white flag, he is expected to acknowledge the warning and refrain from repeating the behavior for the remainder of the race.</p>
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<b>Test Result</b>	Pass	Pass	Pass	Pass	Pass
<b>Tested By</b>	Alejandro Garcia	Ricky Than	Jordan Pastoral	Kevin Knapp	Davis Tran
<b>Test Date</b>	4/20/2024	4/20/2024	4/20/2024	4/20/2024	4/20/2024

### 3.3 AI Test Data Augmentation

For augmenting our AI test data set, we will be paraphrasing and adding typos and grammatical errors to further test the capabilities of our selected AI chatbot's natural language processing (NLP). Below is an example of each of our input test cases and on the other side is the augmented input, reflecting errors in the text that can help identify how well the chatbot can process the language regardless of errors:

<b>Test Case ID</b>	<b>Original Input</b>	<b>Augmented Input</b>
1.1	Who be havin' the most F1 wins?	Who currently holdin' the record for most F1 victory?
1.2	Who has the most F1 won's?	Which driver possesses the highest number of F1 race won's?
1.3	Who has the most F1 wins?	Who is the leading F1 driver in terms of race victories?
2.1	When was the last time that red bull made a new drink?	What is the most recent release of a new beverage by Red Bull?

2.2	Which constructor has the most f1 constructor championships?	Which team has achieved the greatest number of F1 constructors' championships?
3.1	Is Lewis Hamilton	Was Lewis Hamilton
3.2	Is Lewis Hamilton a world champion?	Has Lewis Hamilton ever won a world championship?
4.1	Logan Sargeant is a Formula 1 World Champion.	Logan Sargeant has been declared a Formula 1 World Champion.
4.2	Is Max Verstappen a Formula 1 world champion?	Does Max Verstappen hold any Formula 1 world championship titles?
5.1	How did the rain in the 2021 Russian GP affect the race?	What impact did the rainfall have on the 2021 Russian Grand Prix?
5.2	Which is the oldest race track location still used today?	What is the most historic F1 race track still in operation today?
5.3	What happened in the opening lap of the 2020 Bahrain GP?	Can you describe the events of the first lap in the 2020 Bahrain GP?
5.4	What was controversial about the 2021 Abu Dhabi GP?	Why was the 2021 Abu Dhabi Grand Prix considered controversial?
5.5	What is a Chicane on a racing circuit and what are they common?	Could you explain the function of a chicane on a race circuit and its commonality?
6.1	Which Formula 1 Constructor has earned the most constructors championships?	Which F1 team holds the record for most constructor championships?

6.2	Statistically speaking, which constructor developed the most dominant car in Formula 1 history?	Which F1 constructor is known for creating the most dominant car historically, based on statistics?
6.3	Which one Formula 1 team has the most successful team principal?	Who is the most successful team principal in Formula 1 history?
7.1	Which driver has won the most world championship titles?	Who tops the list for the most world championship titles in F1?
7.2	Which Formula 1 driver holds the record for the most race wins in their career, and what is the total number of wins?	Who is the record holder for the highest number of race wins in F1, and how many wins do they have?
7.3	As of the latest season, who has achieved the highest number of pole positions in Formula 1 history and how many?	Who has secured the most pole positions in the history of Formula 1, and what is the count?
7.4	Who are the top three Formula 1 drivers with the most podium finishes, and what are their respective totals?	Can you name the three F1 drivers with the highest podium finishes and their totals?
7.5	What is the most notable rivalry between drivers that has occurred in the sport of Formula 1?	What is one of the most memorable driver rivalries in Formula 1 history?
8.1	What distinguishes a typical car tire to an F1 car tire?	How does an F1 car tire differ from a regular car tire?
8.2	What were the main advancements made in the power units of F1 cars?	What key improvements have been made to the power units in F1 cars?

8.3	What did the carbon fiber monocoque do to innovate F1 safety regulations?	How has the carbon fiber monocoque contributed to F1 safety innovations?
8.4	How did the transition from v8 naturally aspirated engines to v6 hybrid engines affect F1 cars?	What effects did the shift from V8 to V6 hybrid engines have on F1 cars?
8.5	How did the ground effect change F1 and the technology of cars?	In what ways did the ground effect technology impact Formula 1 by altering car design and enhancing performance?
9.1	What is the max number of chassis a team can use during the F1 season?	How many chassis are F1 teams allowed to use throughout a season?
9.2	How many engines are permitted for each driver over the course of the season before incurring grid penalties?	What is the limit on engine usage per driver in a season before penalties apply?
9.3	During a dry race, how many different tire compounds are available to teams to choose from?	How many types of dry tire compounds can teams select from during a race?
9.4	Is refueling during a race allowed in F1?	Can teams refuel their cars during an F1 race?
9.5	What restrictions are imposed on teams during Parc Ferme conditions?	What are the limitations for F1 teams under Parc Ferme conditions?
9.6	How many points are awarded for a win in an F1 race?	What is the point reward for winning an F1 race?
9.7	What is the budget spending cap for F1 teams?	What is the financial cap for team spending in Formula 1 for the year?

9.8	What does a black and white flag indicate in F1?	What is the significance of the black and white flag in Formula 1?
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### 3.4 AI Test Complexity Analysis

Compared to our conventional testing where we used four black box methods (equivalence partition, decision table, boundary value, and scenario testing) on 5 different AI chatbots, we primarily used category partition testing for our AI test model. Although it is only one method, the number of test cases is significantly higher due to the possible number of test cases that can be generated from the use of 14 different contextual categories and 26 different input categories. This results in 364 test case designs. Additionally, with AI testing, we're not only testing the question answering and knowledge of AI chatbots on F1 but also its understandability on inputs that vary in quality which could vary from containing 0 to n grammatical errors and typos. Some of the standards of understandability fall under being able to identify if the question is relevant to Formula 1 or not, the length of the response and the coherence behind the logic as well as being able to provide evidence along with the response.

## 4. AI Function Test Results & Test Criteria

### 4.1 AI Model-Based Test Results Analysis, Test Complexity & Test Results Statistics

#### 4.1.1 AI Model-Based Test Results Analysis

	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Pass Rate	37/40	36/40	37/40	28/40	25/40
Pass %	92.5%	90.0%	92.5%	70%	62.5%

#### AI Test Model Test Results (40 Test Cases)

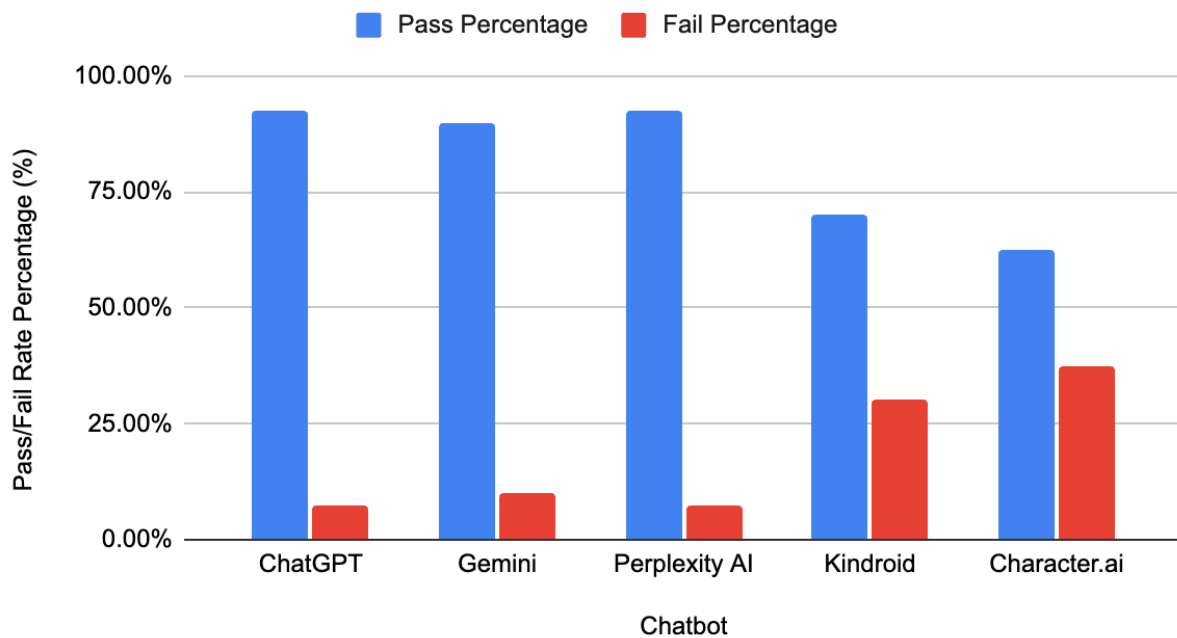


Figure 4.1 Overall Test Case Results



## Context Test Case Coverage

Context	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Quality Pass Rate	3/3	3/3	3/3	0/3	0/3
Relevance Pass Rate	2/2	2/2	2/2	2/2	2/2
Completeness Pass Rate	2/2	2/2	2/2	2/2	2/2
Statement Pass Rate	2/2	2/2	2/2	1/2	1/2
Demographic Pass Rate	5/5	5/5	5/5	5/5	5/5
Total Pass Rate	14/14	14/14	14/14	10/14	10/14
Pass %	100%	100%	100%	71.4%	71.4%

## Context Test Case Result

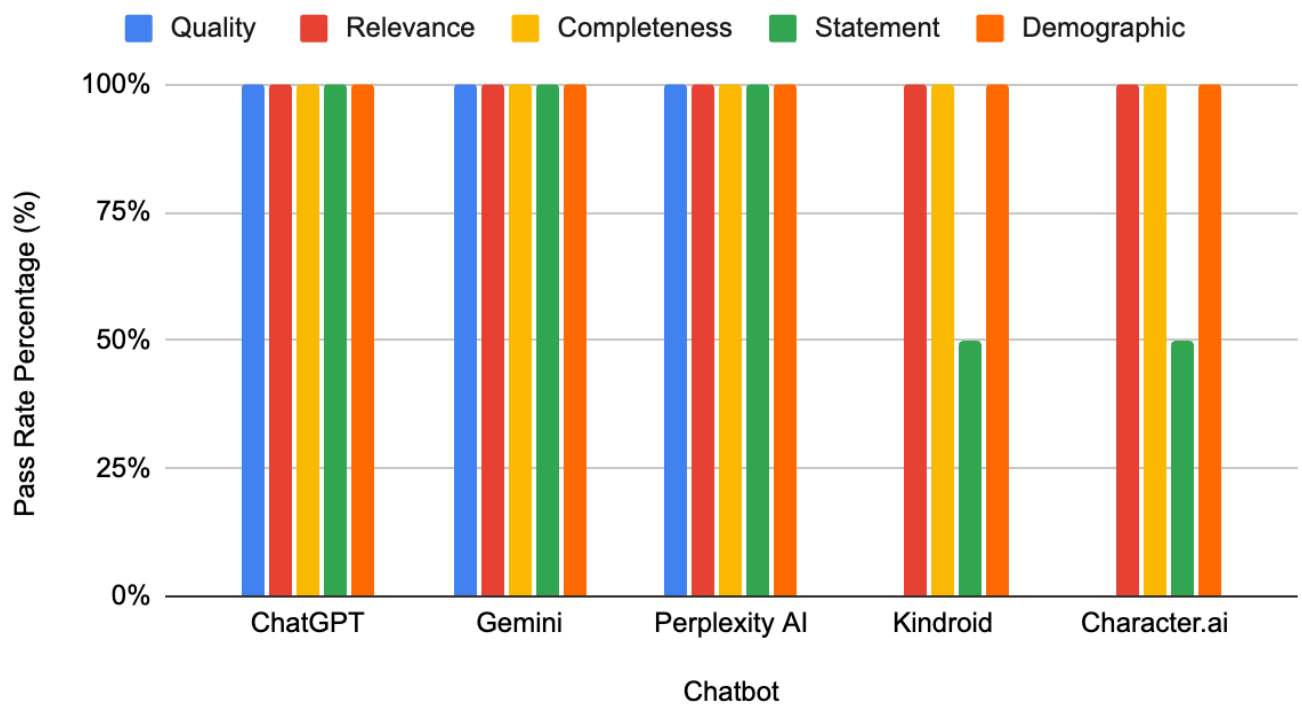


Figure 4.2 Context Text Case Result

## Formula 1 - Input Test Case Coverage

Input	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Race History Pass Rate	5/5	5/5	5/5	4/5	3/5
Constructors Pass Rate	2/3	1/3	1/3	3/3	1/3
Drivers Pass Rate	5/5	5/5	5/5	2/5	1/5
Cars & Technology Pass Rate	5/5	5/5	5/5	4/5	5/5
Rules Pass Rate	6/8	6/8	7/8	5/8	5/8
Total Pass Rate	23/26	22/26	23/26	18/26	15/26
Pass %	88.4%	84.6%	88.4%	69.2%	57.7%

## Input Test Case Result

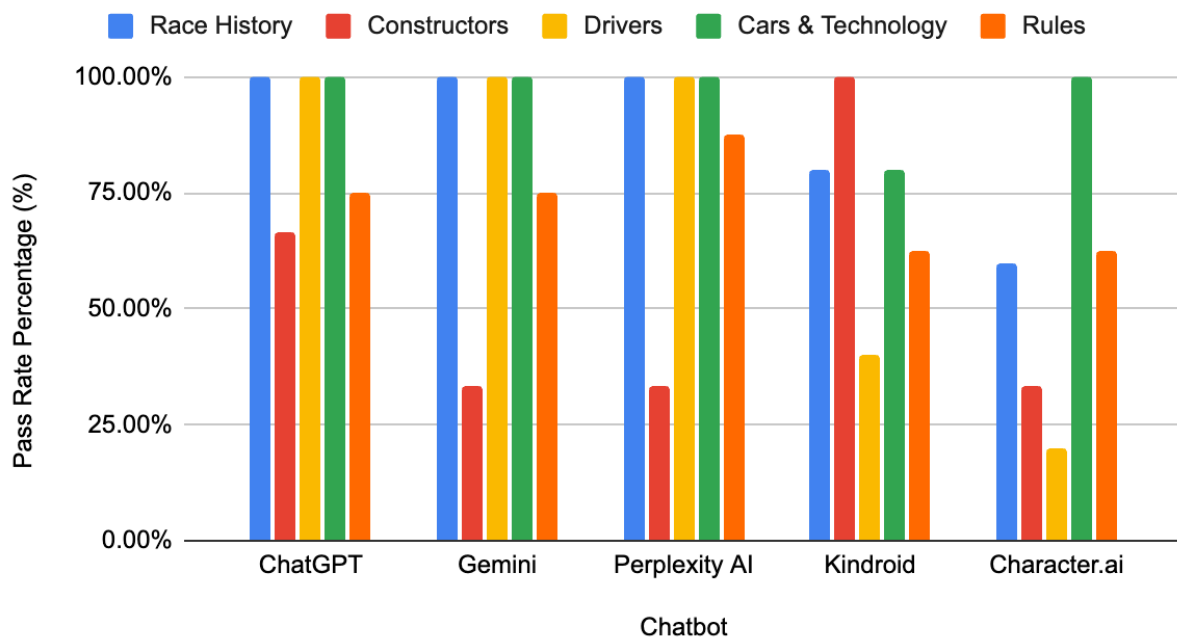


Figure 4.3 Input Test Case Results

## Context &amp; Input Test Coverage

Context & Input	ChatGPT	Gemini	Perplexity AI	Kindroid	Character.ai
Context Pass Percentage	100%	100%	100%	71.4%	71.4%
Input Pass Percentage	88.4%	84.6%	88.4%	69.2%	57.7%

## Context Pass Percentage and Input Pass Percentage

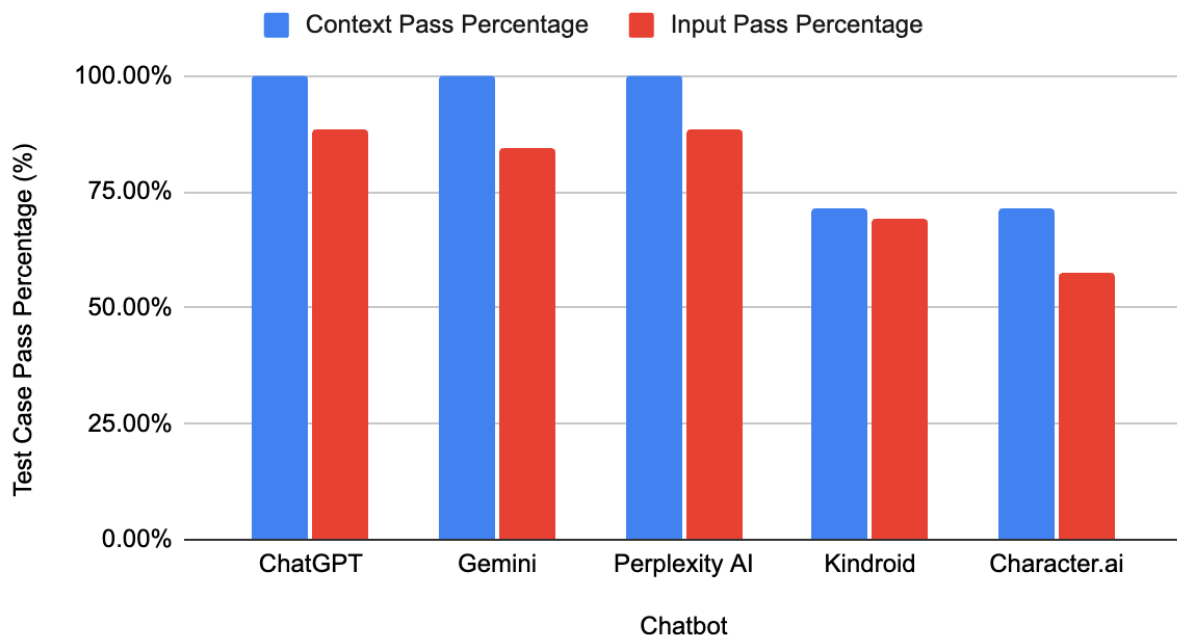


Figure 4.4 Context and Input Test Case Results

## 4.1.2 Test Complexity

In our conventional testing, we had applied four black box testing methods to all five of our ai chatbot applications to test the natural language processing (NLP) feature to test how well the chatbots could generate responses and demonstrate their knowledge for the expansive topic of Formula 1. The four testing methods that we had applied were equivalence partitioning, boundary value testing, decision table testing, and lastly scenario testing. Figure 4.5 below reveals the comparison in the test case number design for each testing method. In the AI Testing, we have generated a substantial number of test cases using the AI Testing Tool, providing more coverage. There are 10 major kinds of context and input test case categories and we have generated 40 test cases that provide complete coverage of all of the categories. For each of the

test cases, we have set a specific parameter as the variable condition but the rest of the conditions remain constant to ensure diverse test results.

## AI Testing Model VS Conventional Testing Method

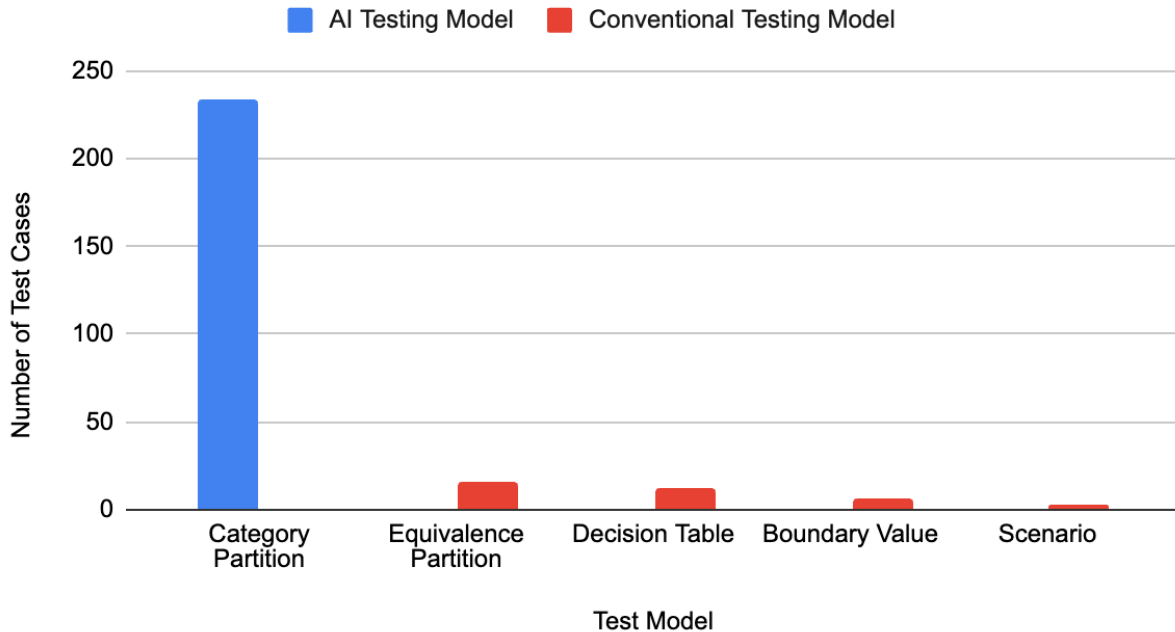


Figure 4.5 Comparison of Test Case Numbers of each Testing Method

While conducting the context based test cases, ChatGPT, Gemini, and Perplexity AI chatbots passed 100% of the test cases. On the other hand, the Kindroid and Character.ai chatbots both received a pass rating of 71.4%, which reveals that they passed 10/14 of the context based test cases. This reveals a significant performance from the first 3 chatbots in the context based testing, when comparing their performance in the Conventional Testing. In both the Conventional testing and the AI testing models, Gemini and Perplexity AI were the best performing chatbots, while the Character.ai chatbot was the worst performing chatbot.

In the input based test cases, no chatbot was able to attain 100% pass rating. The highest rating was achieved by both ChatGPT and Perplexity AI at 88.4%, which means they were able to pass 23/26 test cases. On the other hand, the worst performing chatbot was the Character.ai chatbot with a pass rating of 57.7% at 15/26 test cases passed.

### 4.1.3 Test Statistics

To have a better understanding of the test results, figure 4.6 depicts the total test case generation between the Conventional Testing and the AI Testing. The total number of test cases for the conventional testing was 185 total test cases, in which 160 test cases were passed, and 25 test cases failed. The pass rating for the conventional testing model was 86.48%. For the AI Testing, we had a total of 243 test cases, with 202 of the test cases passing, and 41 test cases that failed. The pass rating for the AI Testing model was 83.12%

#### Total Number of Test Cases, Test Cases Passed and Test Cases Failed

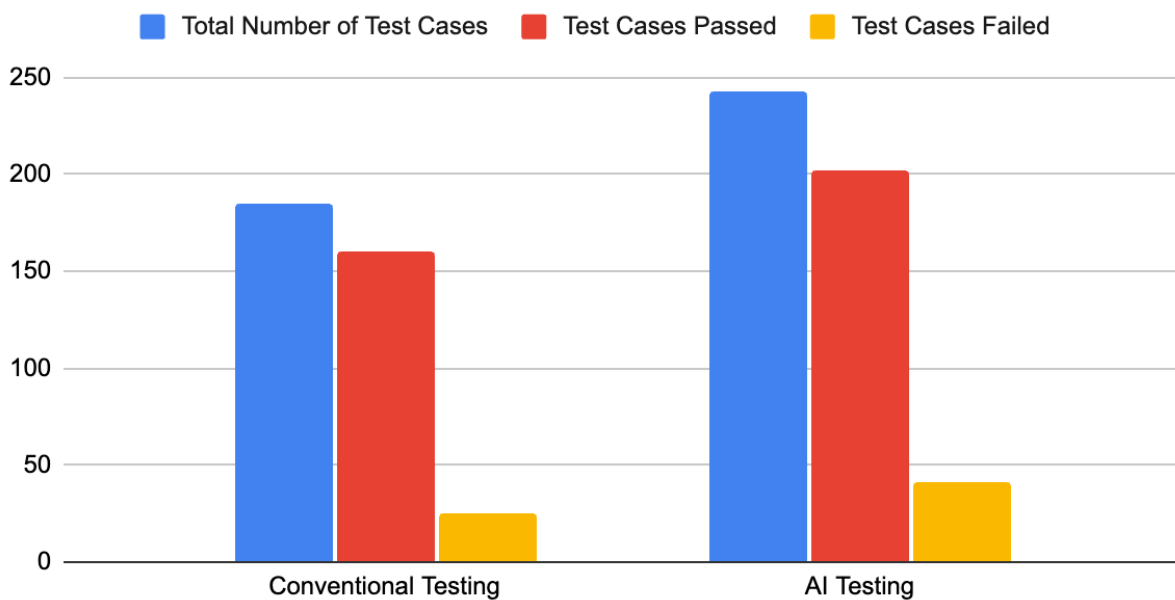


Figure 4.6 Test Result Comparison for Conventional Testing and AI Testing

The overall test results for the AI Test model is depicted in figure 4.7, which reveals the split between the number of context and input test cases. Along with the total number of test cases, there is a pass and fail rate to show how the chatbots performed in the 10 major context and input categories. Most of the chatbot applications passed the context test cases successfully, but there was no chatbot that was able to receive a 100% pass rating for the input test cases.

## AI Test Result Summary

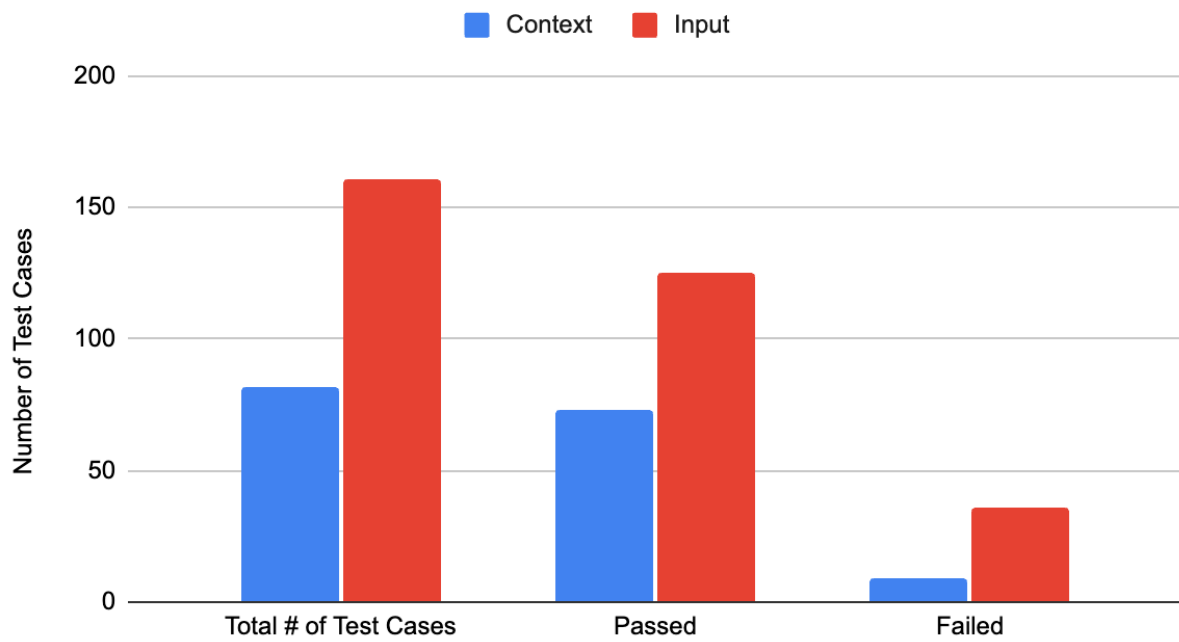


Figure 4.7 AI Test Result Summary

## 4.2 AI Function Bug Analysis

### 4.2.1 Overall Bug Analysis

#### Bug Analysis

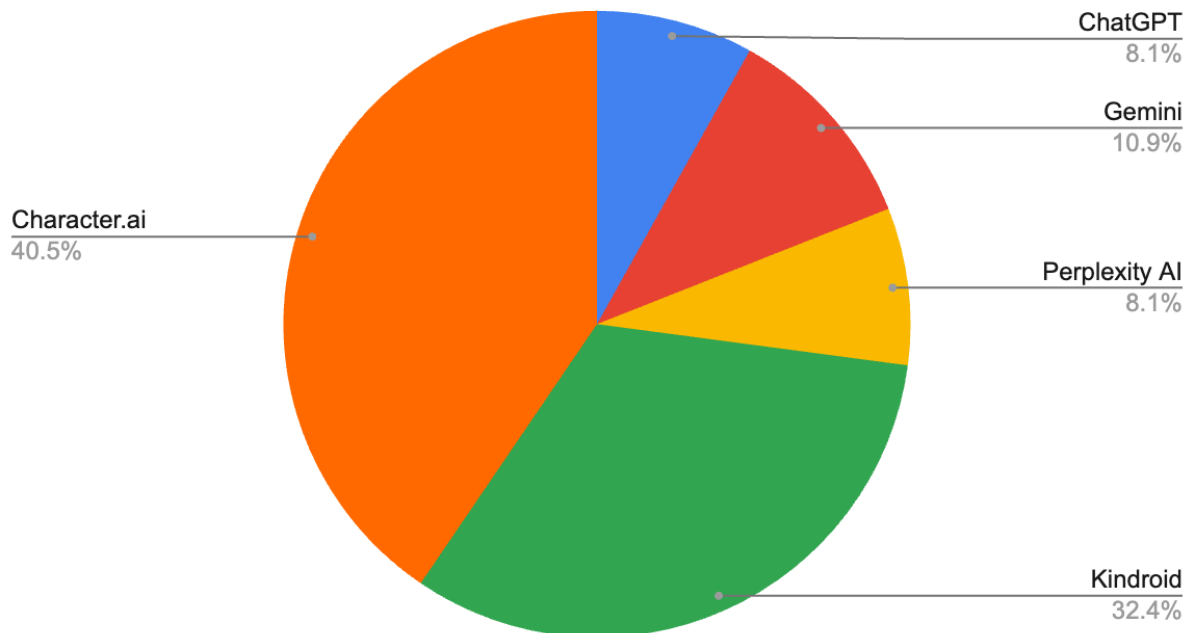


Figure 4.8 Overall Bug Comparison of all Tested AI Chatbots

While testing the 5 AI applications, we had 40 test cases that were used for each application. From the perspective of bugs in all of the test cases that we tested, the Character.ai application is the most buggy application with taking over 40.5% of the total bugs that occurred during the testing process. The applications with the least amount of bugs that occurred during the testing process were ChatGPT and Perplexity AI, which both shared a total of 16.2% of the bugs or a respective 8.1% of the bugs each. The third application that was the least buggy was the Gemini application that had around 10.9% of the total bugs that occurred during the testing. Lastly, the Kindroid application came in as the 2nd worst application, in which it had 32.4% of the total bugs.

## 4.2.2 Bug Analysis For Each Category

### Chatbot Bugs Per Category

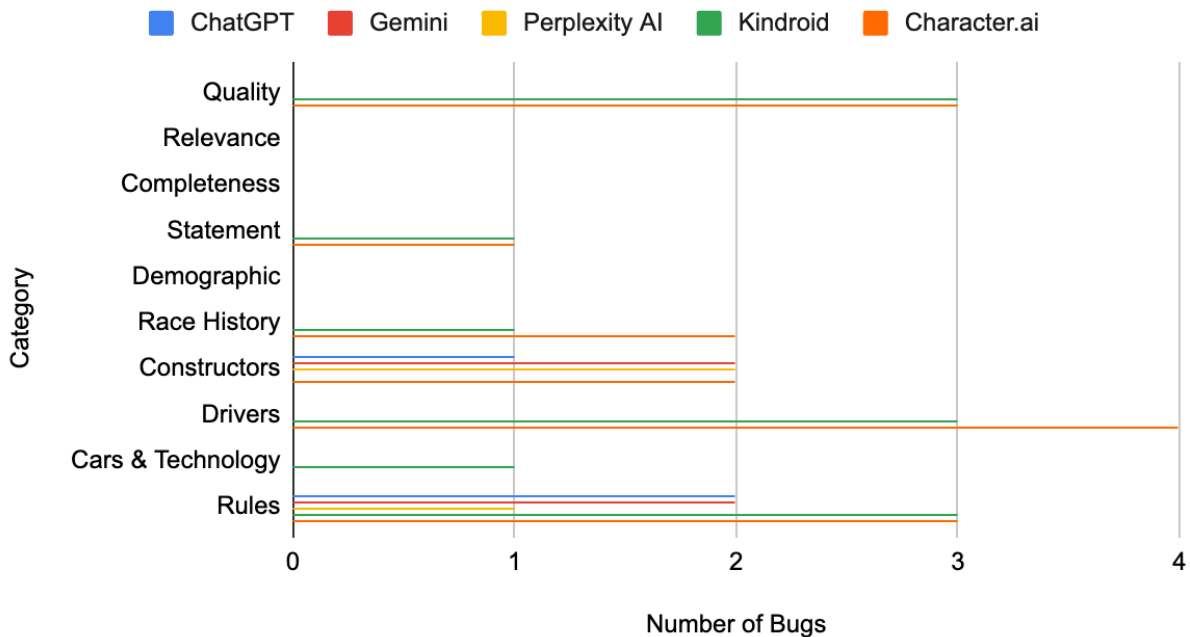


Figure 4.9 Bug Comparison For Each Category in All AI Apps

#### 4.2.2.1 Quality

Both the Kindroid and Character.ai apps failed all 3 of the test cases in the quality category, which means that they need to improve their application to better understand augmented questions. The ChatGPT, Gemini, and Perplexity AI apps all successfully passed the quality category test cases.

#### 4.2.2.2 Relevance

All of the applications passed the test cases that we used in the relevance category.

#### 4.2.2.3 Completeness

All of the applications passed the test cases that we used in the completeness category.

#### 4.2.2.4 Statement

Both the Kindroid and Character.ai apps failed 1 test case each, which means that they need to understand whether the input is either a statement or a question. The ChatGPT, Gemini, and Perplexity AI apps all successfully passed the statement category test cases.



#### 4.2.2.5 Demographic

All of the applications passed the test cases that we used in the demographic category.

#### 4.2.2.6 Race History

The Kindroid application failed 1 of the test cases and the Character.ai application failed 2 of the test cases. The ChatGPT, Gemini, and Perplexity AI apps all successfully passed the race history category test cases.

#### 4.2.2.7 Constructors

Gemini, Perplexity AI, and the Character.ai applications all failed 2 of the test cases and the ChatGPT application failed 1 test case. The Kindroid application was the only application that passed all of the test cases that were used for the constructors subtopic.

#### 4.2.2.8 Drivers

ChatGPT, Gemini, and the Perplexity AI apps passed all 5 of the test cases. The Kindroid app failed 3 of the test cases and the Character.ai application failed 4 of the test cases that were used for the drivers category test cases.

#### 4.2.2.9 Cars & Technology

All applications passed all of the test cases except for the Kindroid app, which failed 1 of the test cases in the cars & technology category test cases.

#### 4.2.2.10 Rules

No application was successful in passing all of the test cases in the rules category. Kindroid and Character.ai failed 3 test cases, ChatGPT and Gemini failed 2 test cases, and Perplexity AI failed 1 test case.

## 4.3 AI Function Test Quality Assessment

For testing the AI function, we decided to pursue the category partition testing model. The testing method that we used was to divide the input and context domain into 5 respective partitions for both of the domains. Within each domain, there were N different disjoint partitions, in which we selected one value from each of the input and context domains to generate a test case that would ensure coverage of the domain.

### 4.3.1 Test Criteria

- Every combination of input and context category partitions is tested at least one
- At least one test case reveals a bug for each incorrect input or context category partition

### 4.3.2 Test Coverage

- Every input category partition that was classified was covered
- Every context category partition that was classified was covered
- Every output category partition that was classified was covered