

TEAM #2025076

PRESENTATION

2025 IM2C



PrepaTec



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TEAM #2025076
PRESENTATION

GLOBAL SPORTS LEAGUE



OUR MODEL MUST:

- Apply to a team-based sport of our choosing.
- Support the participation of at least 20 teams globally.
- Optimize the schedule for fairness and representation.
- Allow expansion and sensitivity analysis under changing conditions.





A sport in which multiple players collaborate to achieve a common objective, ultimately leading to victory in a game or match. To qualify as a sport, it must require a minimum of five players per team actively participating at all times.

-IMMC

S



BRAWL STARS

Brawl Stars is a free multiplayer online battle arena and third-person hero shooter video game with more than 400 million downloads worldwide.

5 vs 5 fast-paced

matches
World-wide server support

No need for

travel
Zero CO2

emissions
Low organization

cost

TEAM SELECTION:

We took into account

- Competitive Performance
- Geographic Diversity
- Organizational Stability
- Emerging Regionsand Accessibility

#	Team	Country	Continent	UTC Offset	Nearest hub	
1	ZETA DIVISION	Japan	Asia	9	Tokyo	
2	Crazy Raccoon	Japan	Asia	9	Tokyo	
3	Gen.G Esports	South Korea	Asia	9	Tokyo	
4	Rival Esports	Singapore	Asia	8	Singapore	
5	LOUD Esports	Brazil	South America	-3	São Paulo	
6	Inferno Azul	Argentina	South America	-3	São Paulo	
7	Tribe Gaming	United States (Austin)	North America	-5 to -8	Dallas	
8	STMN Esports	United States (Denver)	North America	-5 to -8	Dallas	
9	Elevate	United States (Miami)	North America	-5 to -8	Dallas	
10	F/A Panafresh	Mexico	North America	-6	Dallas	
11	Spacestation Gaming	Canada (Toronto)	North America	-5	Dallas	
12	SK Gaming	Germany	Europe	1	Frankfurt	
13	Totem Esports	Italy	Europe	1	Frankfurt	
14	FUT Esports	Turkey	Europe	3	Frankfurt	
15	Team Heretics	Spain	Europe	1	Frankfurt	
16	NAVI	Ukraine	Europe	2	Frankfurt	
17	Anubis Core Gaming	Egypt	Africa	2	Frankfurt	
18	Bourg Reapers	South Africa	Africa	2	Mumbai	
19	Sydney Shockwave	Australia	Oceania	10	Singapore	
20	Kiwi Blitz	New Zealand	Oceania	12	Singapore	

ASSUMPTIONS:

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KEY SCHEDULING FACTORS:

- o Time zone offset
- o Server latency difference
- o Geographic clustering
- o Opponent diversity (repeat avoidance)
- o Match frequency
- o Update alignment regularity
- o Sensitivity



KEY SCHEDULING FACTORS:

- o Time zone offset difference

$$S_{timezone}(i, j) = 1 - \frac{|UTC_i - UTC_j|}{12}$$

Where 1 = perfect time alignment, 0 = maximum 12-hour misalignment.

o Server latency difference

o Geographic clustering

o Opponent diversity (repeat avoidance)

o Match frequency regularity

o Update alignment sensitivity

KEY SCHEDULING FACTORS:

o Server latency difference

$$S_{latency}(i, j) = \frac{2}{1 + \exp(0.02 \times (L_{ij} - 120))} - 1$$

Where:

- L_{ij} is latency in milliseconds between teams i and j .
- 120 ms is the competitive latency threshold (based on studies and industry standards).

KEY SCHEDULING FACTORS:

- o Geographic

$$S_{geo}(i, j) = \begin{cases} 1 & \text{if } Continent_i \neq Continent_j \\ 0.5 & \text{if } Continent_i = Continent_j \end{cases}$$

Higher scores reward matchups between teams from different regions, promoting cultural exchange and visibility.

- o Opponent diversity (repeat avoidance)

- o Match frequency regularity

- o Update alignment sensitivity

- o Time zone offset difference

- o Server latency difference

KEY SCHEDULING FACTORS:

- o Opponent diversity (repeat avoidance)

$$S_{repeat}(i, j) = 1 - \frac{R_{ij}}{M}$$

Where:

- R_{ij} is the number of rematches between teams
- M is the maximum allowable rematches (set to 2 in our model)

A score of 1 means no rematches (ideal), and 0 means maximum allowed rematches.

KEY SCHEDULING FACTORS:

o Match frequency

$$S_{freq}^{regularity}(i, j) = 1 - \frac{\sigma_i}{max(\sigma)}$$

Where:

- σ_i is the standard deviation of team i 's match intervals.
- $max(\sigma)$ is the highest standard deviation observed across all teams.

Lower deviation = more balanced schedule = higher score.

o Update alignment
sensitivity

o Time zone offset
difference

o Server latency difference

o Geographic
clustering

o Opponent diversity (repeat
avoidance)

KEY SCHEDULING FACTORS:

- o Update alignment

sensitivity

$$S_{patch}(i, j, t) = \begin{cases} 0.5 & \text{if match } t \text{ occurs during a patch week,} \\ 1 & \text{otherwise} \end{cases}$$

Supercell typically releases updates every 4–6 weeks, introducing balance changes that may favor or disadvantage specific team compositions. Avoiding matchups during these periods enhances competitive fairness.

- o Time zone offset difference

- o Server latency difference

- o Geographic clustering

- o Opponent diversity (repeat avoidance)

- o Match frequency regularity

KEY SCHEDULING FACTORS:

- o Time zone offset
- o Server latency difference
- o Geographic clustering
- o Opponent diversity (repeat avoidance)
- o Match frequency
- o Update alignment regularity
- o Sensitivity



WEIGHT ASSESSMENT VIA A.H.P.

Value	
	1
	3

The Analytic Hierarchy Process(AHP) is a structured decision-making framework for evaluating multiple criteria.

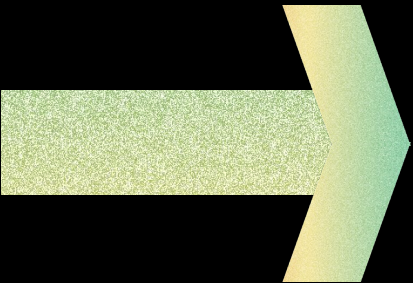
	Latency (L)	Time-zone (T)	Geo div. (G)	Opp. div. (O)	Freq. bal. (F)	Patch (P)
L	1	3	3	5	5	7
T	$\frac{1}{3}$	1	3	5	5	7

A 6×6 pairwise comparison matrix was constructed based on expert input to compare the relative importance of each factor. The matrix adhered to AHP principles:

- All comparisons used the AHP scale (1–9).
- Reciprocal values were used (if A is $3 \times$ more important than B, then B is $1 / 3$ compared to A).
- For example:
 - Server latency was rated as more important than time zone.
 - Time zone was rated as more important than opponent diversity or patch updates.

(divide every entry by the sum of its column; now each column totals 1)

	L- norm	T- norm	G- norm	O- norm	F- norm	P- norm
L	0.316	0.194	0.162	0.129	0.112	0.087
T	0.105	0.194	0.162	0.129	0.112	0.087
G	0.105	0.065	0.162	0.129	0.112	0.062



Factor	weight f
Server Latency	0.3160
Time-zone Offset	0.1936
Geographic	0.1622

(Threedecimal rounding for slide legibility; full-precision values were used in the maths.)

CONSISTENCY CHECK

$$\lambda_{max} = 6.123$$

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{6.123 - 6}{6 - 1} = 0.0246$$

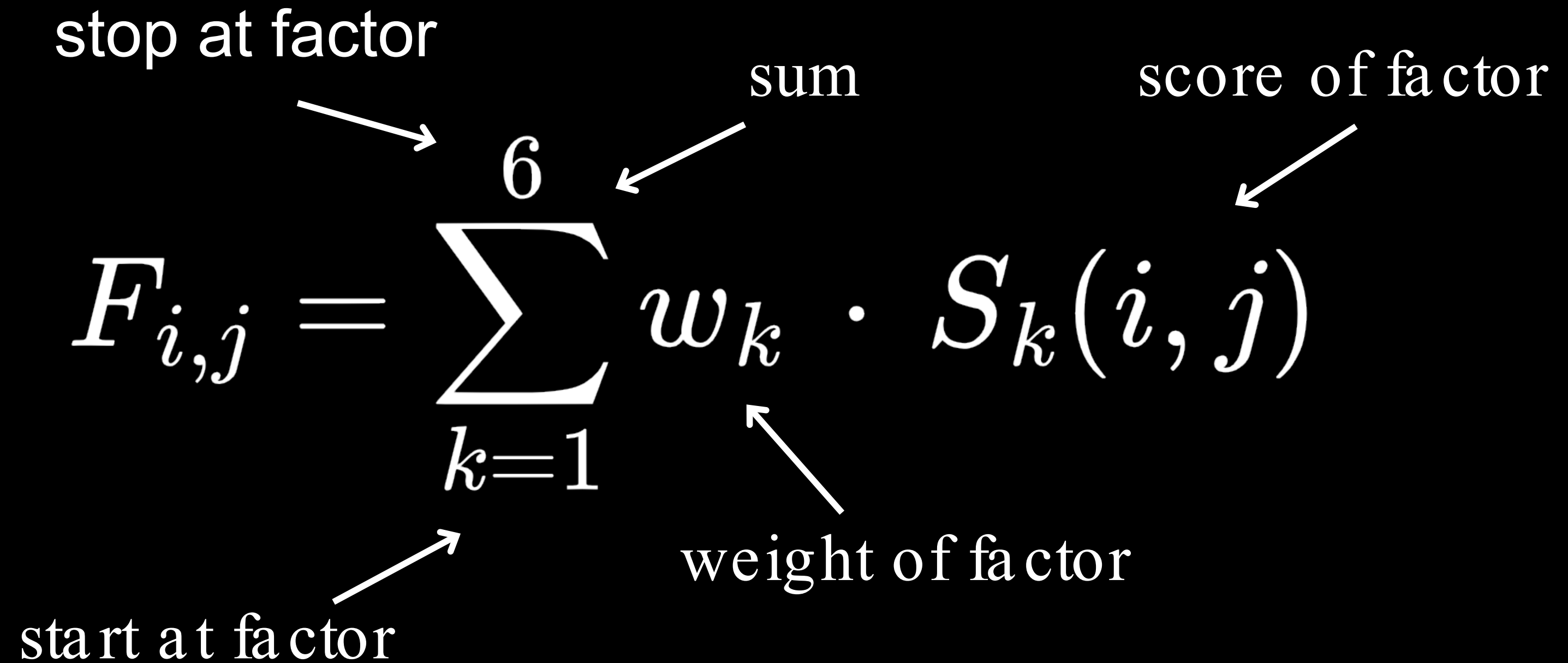
$$RI = 1.24 (n = 6)$$

$$CR = \frac{CI}{RI} = \frac{0.0246}{1.24} \approx 0.0199$$

FAIRNESS SCORE FORMULA

$$F_{i,j} = \sum_{k=1}^6 w_k \cdot S_k(i, j)$$

FAIRNESS SCORE FORMULA



The diagram illustrates the Fairness Score Formula with annotations for its components:

$$F_{i,j} = \sum_{k=1}^6 w_k \cdot S_k(i, j)$$

- stop at factor**: Points to the upper limit 6 of the summation.
- sum**: Points to the summation symbol $\sum$.
- score of factor**: Points to the term $S_k(i, j)$.
- weight of factor**: Points to the weight w_k .
- start at factor**: Points to the lower limit $k=1$ of the summation.

#	Team Name	Country	Continent	UTC Offset	Origin
1	ZETA DIVISION	Japan	Asia	9	Real
2	Crazy Raccoon	Japan	Asia	9	Real
3	Gen.G Esports	South Korea	Asia	9	Real
4	Rival Esports	Singapore	Asia	8	Real
5	LOUD Esports	Brazil	South America	-3	Real
6	Infierno Azul	Argentina	South America	-3	Invented
7	Tribe Gaming	United States	North America	-5 to -8	Real
8	STMN Esports	United States	North America	-5 to -8	Real
9	Elevate	United States	North America	-5 to -8	Real
10	F/A Panafresh	Mexico	North America	-6	Real
11	Spacestation Gaming	Canada	North America	-5	Real
12	SK Gaming	Germany	Europe	1	Real
13	Totem Esports	Italy	Europe	1	Real
14	FUT Esports	Turkey	Europe	3	Real
15	Team Heretics	Spain	Europe	1	Real
16	NAVI	Ukraine	Europe	2	Real
17	Anubis Core Gaming	Egypt	Africa	2	Invented
18	Joburg Reapers	South Africa	Africa	2	Invented
19	Sydney Shockwave	Australia	Oceania	10	Invented
20	Kiwi Blitz	New Zealand	Oceania	12	Invented

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20	Kiwi Blitz	New Zealand	Oceania	12	Inven

#	Factor	Sk
1	Server latency	0.876
2	Time-zone offset	0.42

$$F_{(NAVI, LOUD)} = 0.8187$$

SCHEDULING

1. Generated all possible pairwise matchups
2. Score each matchup using the composite fairness function
3. Ranked all matchups by descending fairness score.
4. Assigned matches to weeks under a constraint-based optimization process
5. Validated and rebalance the schedule to ensure equity.

SCHEDULING

1. Generated all possible pairwise matchups

$$\binom{n}{2} = \frac{n(n-1)}{2} \implies \binom{20}{2} = \frac{20(19)}{2} = 190.$$

SCHEDULING

2. Score each matchup using the composite fairness function

	ZETA DIVISION	Crazy Raccoon	Gen.G Esports	Rival Esports	LOUD Esports	Inferno Azul	Tribe Gaming	STMN Esports	Elevate	F/A Panafres h	Spacestat ion Gaming	SK Gaming	Totem Esports	FUT Esports	Team Heretics	NAVI	Anubis Core Gaming	Bourg Reapers	Sydney Shockwa ve	Kiwi Blitz
ZETA DIVISION		0.858	0.818	0.841	0.744	0.651	0.687	0.67	0.655	0.668	0.671	0.808	0.772	0.792	0.775	0.783	0.741	0.277	0.742	0.604
Crazy Raccoon	0.858		0.818	0.841	0.744	0.651	0.687	0.67	0.655	0.668	0.671	0.808	0.772	0.792	0.775	0.783	0.741	0.277	0.742	0.604
Gen.G Esports	0.818	0.818		0.8	0.704	0.574	0.645	0.621	0.599	0.614	0.611	0.766	0.713	0.728	0.718	0.722	0.666	0.267	0.652	0.518
Rival Esports	0.841	0.841	0.8		0.759	0.665	0.702	0.685	0.67	0.683	0.686	0.823	0.786	0.806	0.789	0.797	0.755	0.293	0.723	0.585
LOUD Esports	0.744	0.744	0.704	0.759		0.761	0.879	0.863	0.848	0.86	0.863	0.871	0.834	0.79	0.838	0.813	0.771	0.309	0.546	0.407
Inferno Azul	0.651	0.651	0.574	0.665	0.761		0.783	0.75	0.722	0.739	0.732	0.775	0.706	0.653	0.711	0.681	0.616	0.295	0.376	0.259
Tribe Gaming	0.687	0.687	0.645	0.702	0.879	0.783		0.837	0.821	0.818	0.788	0.814	0.776	0.731	0.78	0.755	0.712	0.252	0.486	0.348
STMN Esports	0.67	0.67	0.621	0.685	0.863	0.75	0.837		0.798	0.795	0.763	0.797	0.752	0.705	0.756	0.73	0.68	0.247	0.446	0.308
Elevate	0.655	0.655	0.599	0.67	0.848	0.722	0.821	0.798		0.775	0.741	0.781	0.73	0.682	0.735	0.707	0.653	0.244	0.415	0.279
F/A Panafres h	0.668	0.668	0.614	0.683	0.86	0.739	0.818	0.795	0.775		0.756	0.794	0.745	0.697	0.75	0.722	0.669	0.253	0.432	0.296
Spacestat ion Gaming	0.671	0.671	0.611	0.686	0.863	0.732	0.788	0.763	0.741	0.756		0.797	0.743	0.693	0.748	0.72	0.663	0.267	0.423	0.289
SK Gaming	0.808	0.808	0.766	0.823	0.871	0.775	0.814	0.797	0.781	0.794	0.797		0.816	0.771	0.819	0.795	0.833	0.373	0.607	0.469
Totem Esports	0.772	0.772	0.713	0.786	0.834	0.706	0.776	0.752	0.73	0.745	0.743	0.816		0.714	0.768	0.74	0.766	0.365	0.526	0.392
FUT Esports	0.792	0.792	0.728	0.806	0.79	0.653	0.731	0.705	0.682	0.697	0.693	0.771	0.714		0.719	0.723	0.745	0.363	0.536	0.405
Team Heretics	0.775	0.775	0.718	0.789	0.838	0.711	0.78	0.756	0.735	0.75	0.748	0.819	0.768	0.719		0.745	0.771	0.365	0.532	0.397
NAVI	0.783	0.783	0.722	0.797	0.813	0.681	0.755	0.73	0.707	0.722	0.72	0.795	0.74	0.723	0.745		0.773	0.38	0.533	0.4
Anubis Core	0.741	0.741	0.666	0.755	0.771	0.616	0.712	0.68	0.653	0.669	0.663	0.833	0.766	0.745	0.771	0.773		0.295	0.469	0.348

SCHEDULING

3. Ranked all matchups by descending fairness score.

Team	Opponent	Fairness Score
LOUD Esports	Tribe Gaming	0.879
Tribe Gaming	LOUD Esports	0.879
SK Gaming	LOUD Esports	0.871
LOUD Esports	SK Gaming	0.871
LOUD Esports	Spacestation Gaming	0.863
STMN Esports	LOUD Esports	0.863
LOUD Esports	STMN Esports	0.863
Spacestation Gaming	LOUD Esports	0.863
LOUD Esports	F/A Panafresh	0.86
F/A Panafresh	LOUD Esports	0.86
Crazy Raccoon	ZETA DIVISION	0.858
ZETA DIVISION	Crazy Raccoon	0.858

LOUD Esports	Elevate	0.848
Elevate	LOUD Esports	0.848
ZETA DIVISION	Rival Esports	0.841
Rival Esports	Crazy Raccoon	0.841
Rival Esports	ZETA DIVISION	0.841
Crazy Raccoon	Rival Esports	0.841
LOUD Esports	Team Heretics	0.838
Team Heretics	LOUD Esports	0.838
STMN Esports	Tribe Gaming	0.837
Tribe Gaming	STMN Esports	0.837
LOUD Esports	Totem Esports	0.834
Totem Esports	LOUD Esports	0.834
Anubis Core Gaming	SK Gaming	0.833
SK Gaming	Anubis Core Gaming	0.833

SK Gaming	Rival Esports	0.823
Rival Esports	SK Gaming	0.823
Elevate	Tribe Gaming	0.821
Tribe Gaming	Elevate	0.821
SK Gaming	Team Heretics	0.819
Team Heretics	SK Gaming	0.819
F/A Panafresh	Tribe Gaming	0.818
Gen.G Esports	Crazy Raccoon	0.818
ZETA DIVISION	Gen.G Esports	0.818
Crazy Raccoon	Gen.G Esports	0.818
Tribe Gaming	F/A Panafresh	0.818
Gen.G Esports	ZETA DIVISION	0.818
Totem Esports	SK Gaming	0.816
SK Gaming	Totem Esports	0.816

SCHEDULING

4. Assigned matches to weeks under a constraint based optimization process

- C1: No team plays more than once per week.
- C2: Minimize repeated high-latency or crosstime zone matches in the same window.
- C3: Avoid scheduling sensitive matches during patch weeks.
- C4: Space out repeat opponents for viewer diversity.
- C5: Prioritize high-fairness matchups earlier in the season.

SCHEDULING

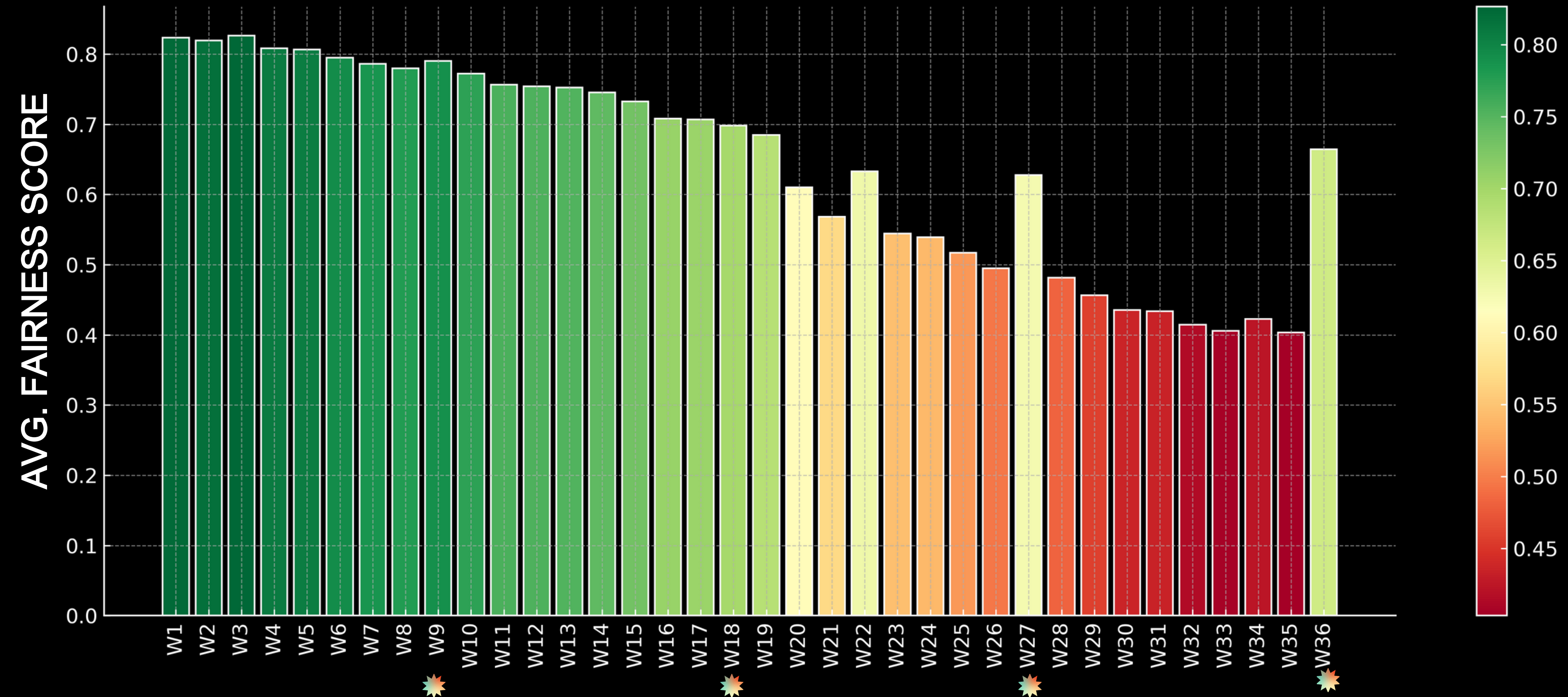
5. Validated and rebalance the schedule to ensure equity.

$$\bar{F}_i = \frac{1}{19} \sum_{j \neq i} F(i, j)$$

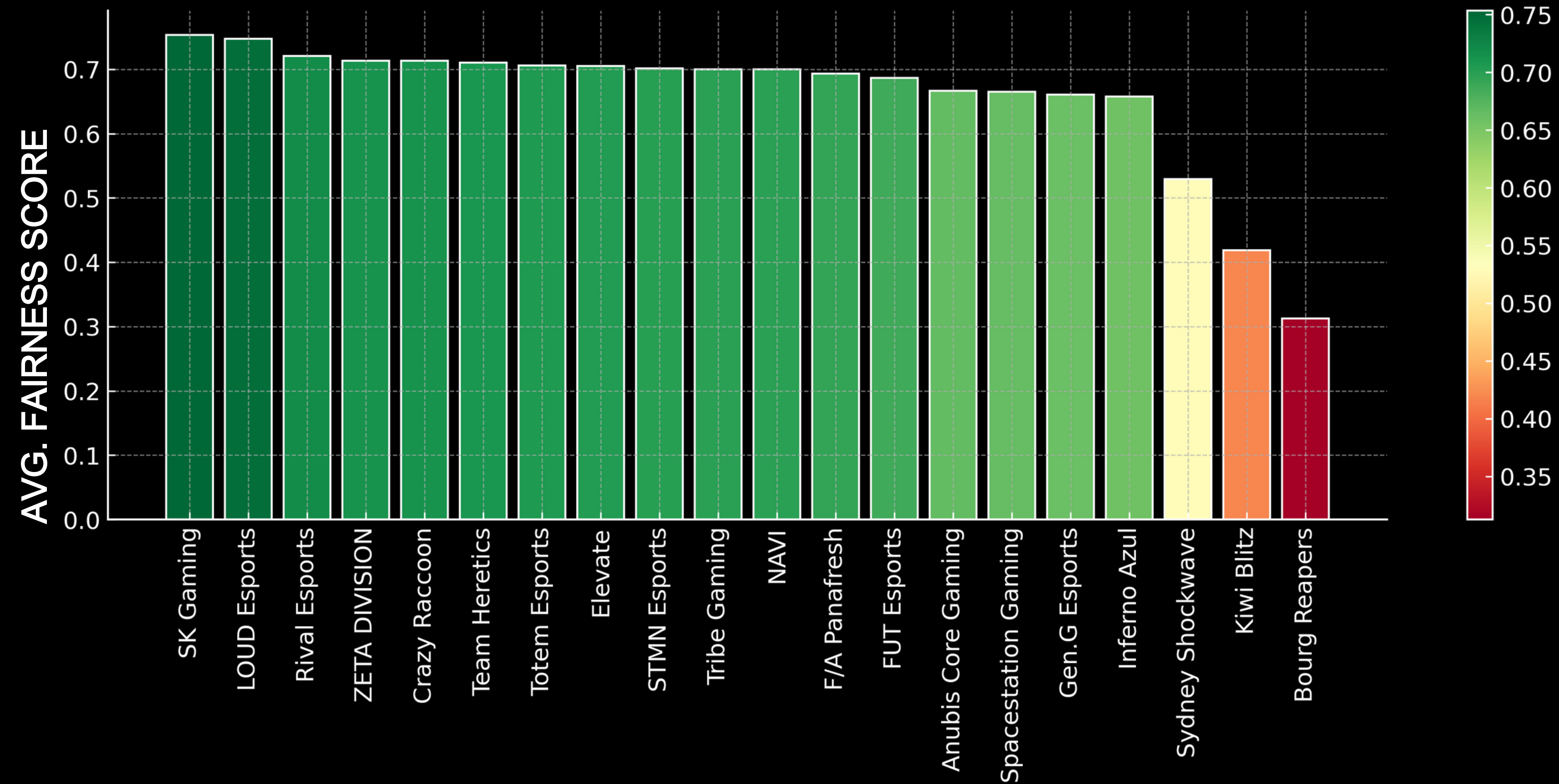
We analyze:

- Leaguewide fairness distribution.
- Maximum vs. minimum per team fairness

AVERAGE FAIRNESS PER WEEK



AVERAGE FAIRNESS PER TEAM



LEAGUE STATS.

Metric
Total Matches Scheduled
Matches Needing Inspection

FLAGGED MATCHES (< 0.3)

Elevate
Inferno Azul
F/A Panafresh
STMN Esports

LEAGUE EXPANSION

4 EXTRA TEAMS:

Team	Country	Nearest Hub	Avg. Ping (ms)
Cairo Mirage	Egypt	Frankfurt	56
Manila Tempest	Philippines	Singapore	25
Buenos Aires Clash	Argentina	São Paulo	60
Perth Shadows	Australia	Singapore	70

LEAGUE EXPANSION

4 EXTRA TEAMS:

Team	Country	Nearest Hub	Avg. Ping (ms)
Cairo Mirage	Egypt	Frankfurt	56
Manila Tempest	Philippines	Singapore	25
Buenos Aires Clash	Argentina	São Paulo	60
Perth Shadows	Australia	Singapore	70

$$\binom{n}{2} = \frac{n(n-1)}{2}$$

LEAGUE EXPANSION

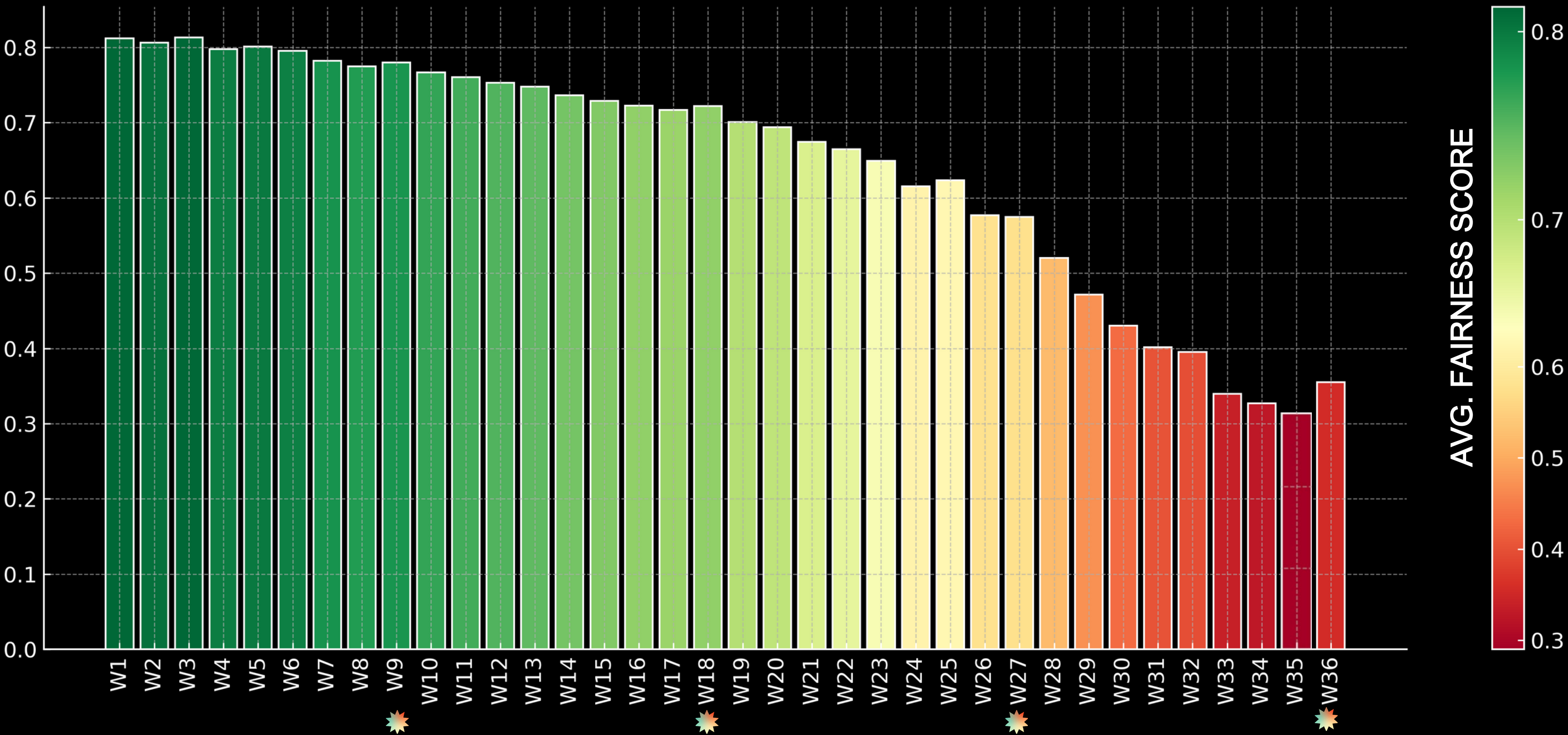
4 EXTRA TEAMS:

Team	Country	Nearest Hub	Avg. Ping (ms)
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Buenos Aires Clash	Argentina	São Paulo	60
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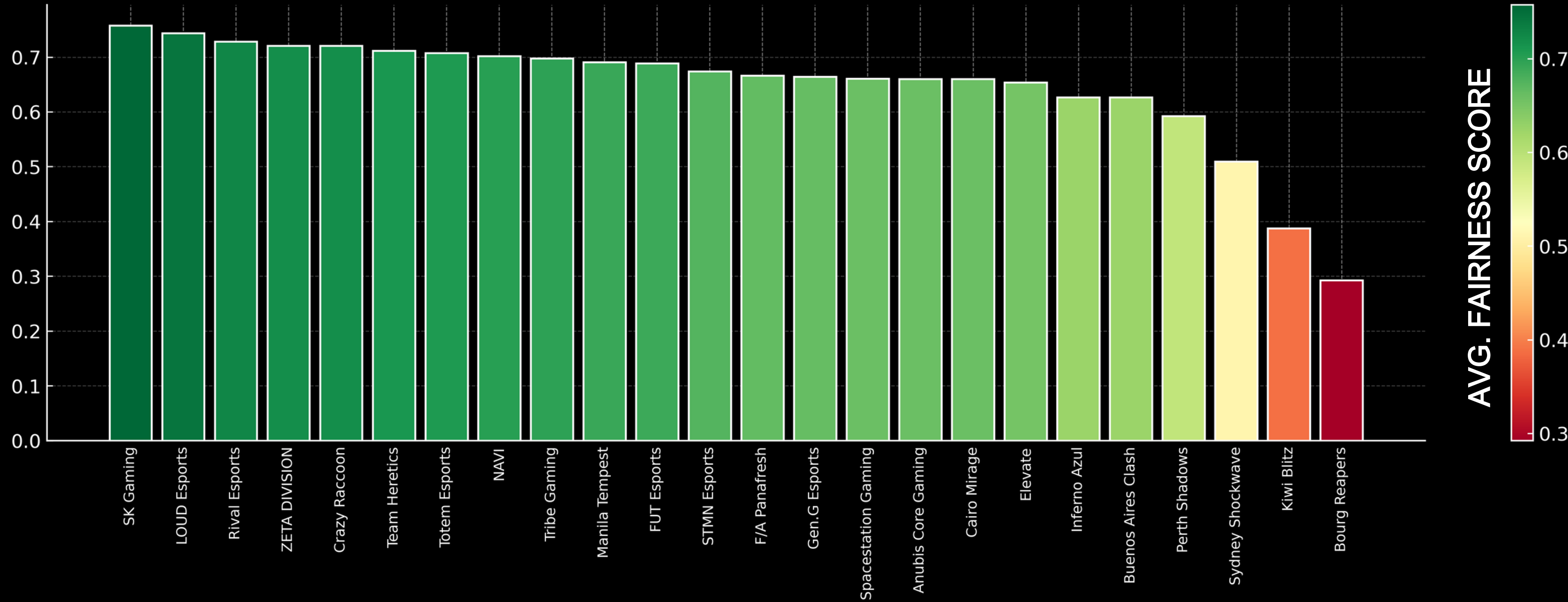
$$\binom{n}{2} = \frac{n(n-1)}{2}$$

$$\binom{24}{2} = \frac{24(23)}{2} = 276$$

AVERAGE FAIRNESS PER WEEK (24 TEAMS)



AVERAGE FAIRNESS PER TEAM (24 TEAMS)



NEW LEAGUE STATS.

Metric
Total matches scheduled
Matches Needing Inspection
Season length

FLAGGED MATCHES (< 0.3)

Bourg Reapers	vs.	Kiwi
Bourg Reapers	vs.	Sydney Shock
Elevate	vs.	Bourg Reapers
STMN Esports	vs.	Bourg Reapers
Tribe Gaming	vs.	Bourg Reapers
F/A Panafresh	vs.	Bourg Reapers
		Bourg Reapers

PRE VS POST EXPANSION.

Metric
Total Matches Scheduled
Matches Needing Inspection
Weeks

Metric
Total matches scheduled
Matches Needing Inspection
Season length

ADAPTING TO OTHER SPORTS

Origin
Server
Time Zone
Update

THANKS

!