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A note on “Scheduling the South American Qualifiers to the 2018 FIFA World Cup by integer programming”

Jamer José Rebolledo Quiroz Juan Carlos Rivera Agudelo[‡ I]
Departamento de Ciencias Matemáticas
Escuela de Ciencias

Universidad EAFIT
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1. PROBLEM DESCRIPTION

- In South America, every 4 years, 10 national soccer teams compete for one of the 4.5 spots in the World Cup.
- This process is made via a tournament “all against all”, where all teams play twice against each other.
- The configuration of the matches, have to keep some restrictions and also favorably, a symmetry scheme.

1. PROBLEM DESCRIPTION

- In 2017, Durán et al. (2017) used integer lineal programming to propose schedules that meet all the requirements.
- They introduced some symmetry schemes to finally adopt the French One.
- In this research, we want to analyze the symmetry schemes proposed in order to compare time convergence and features.
- Also, additional features are proposed based on the observed results.

2. STATE OF THE ART

Durán et al. (2017) proposed the followings symmetry schemes

Scheme	Schedule										
Mirrored scheme	1	2	3	...	9	1	2	3	...	8	9
French scheme	1	2	3	...	9	2	3	4	...	9	1
English scheme	1	2	3	...	9	9	1	2	...	7	8
Inverted scheme	1	2	3	...	9	9	8	7	...	2	1
Back to back scheme	1	1	2	...	5	5	6	6	...	9	9

Table 1. Symmetry schemes

2. STATE OF THE ART

Some of the restrictions incompatible with some schemes, for example

- The back-to-back scheme is not compatible with the first double robin constraint: every team faces every other once in the first half and once in the second half.
- The mirrored scheme is incompatible with the balance constraints.

3. COMPUTATIONAL EXPERIMENTS

We simulate the schemes with twice number of teams (20) and got the following results

Scheme	Objective Function	Time (s)
No scheme	4	TLE
Mirrored	37	TLE
French	0	39.99
English	0	35.4
Inverted	0	241.79
Back-to-back	0	7.73

Table 2. Computational times for the schemes

We also experimented with 50 and 100 teams but only the back-to-back give us a solution for 50 teams in a considerable time (1585.44s).

4. ADDITIONAL FEATURES

We proposed two additional features to add to the model

- In half of the matches, every team must play against the best teams once as local once as visitant.
- No more than 2 H-A or A-H consecutive sequences.

This features keep the feasibility of the model and don't increase the computational time.

REFERENCES

Durán, G., Guajardo, M., & Sauré, D. (2017). Scheduling the south american qualifiers to the 2018 fifa world cup by integer programming. *Elsevier*.

Muchas gracias.
¿Preguntas?

Jamer José Rebolledo Quiroz
jjrebolleq@eafit.edu.co