

## 1 General Infomation

The current representation of the (double) Round Robin tournament:  $MD \in \mathbb{B}^{nt \times nd \times nt}$

If compact scheme:

$$nt > 1$$

$$nd = (nt - 1) * 2 \text{ if } nt \% 2 = 0$$

$$nd = nt * 2 \text{ if } nt \% 2 = 1$$

## 2 Used operators

$$SumHomerow(d, t) = \sum_i MD[d][t][i]$$

$$SumAwayrow(d, t) = \sum_i MD[d][i][t]$$

$$SumRounds(h, a) = \sum_i MD[i][h][a]$$

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## 3 Constraint Table

Index	Constaint	Mathematical notation
C01	Team $t_j$ can not play home in round $r_k$	$SumHomerow(k, j) = 0$
C02	Team $t_j$ ca nnot play away in round r $r_k$	$SumeAwayrow(k, j) = 0$
C03	Team $t_j$ can not play at all in round $r_k$	$SumHomerow(k, j) + SumAwayrow(k, j) = 0$
C04	There should be at least $m_1$ and at most $m_2$ homegames for teams $t_1, t_2, \dots$ on the same day d	$m_1 \leq SumHomerow(d, 1) + SumHomerow(d, 2) \leq m_2$
C05	No team can play against itself	$\forall d, t : MD[d][t][t] = 0$
C06	Team t wishes to play at least $k_1$ and at most $k_2$ homegames between round $r_i$ and round $r_j$	$k_1 \leq \sum_{x=i}^j SumHomerow(x, t) \leq k_2$
C07	Team t wishes to play at least $k_1$ and at most $k_2$ awaygames between round $r_i$ and round $r_j$	$k_1 \leq \sum_{x=i}^j SumAwayrow(x, t) \leq k_2$
C08	There are at most R rounds available for the tournament	$nd \leq R$

C09	A maximum of m games can be assigned to round r	$\sum_t : SumHomerow(r, t) \leq m$
C10	Game $t_j$ vs $t_k$ must be pre-assigned to round r	$MD[r][j][k] = 1$
C11	Game $t_j$ vs $t_k$ must not be assigned to round r	$MD[r][j][k] \neq 1$
C12	A break cannot occur in round $r_i$	$\forall t : (SumHomerow(i, t) + SumHomeRow(i - 1, t)) \leq 1 \wedge (SumAwayrow(i, t) + SumAwayRow(i - 1, t)) \leq 1 \wedge 1 \leq i$
C13	Teams cannot have more than k consecutive home games	$\forall t : \sum_{x=i}^{i+k} SumHomeRow(x, t) \leq k$
C14	Teams can not have more than k consecutive away games	$\forall t : \sum_{x=i}^{i+k} SumAwayRow(x, t) \leq k$
C15	The total number of breaks must not be larger than k	<i>TODO Discuss</i>
C16	The total number of breaks per team must not be larger than k	<i>TODO Discuss</i>
C17	Every team must have an even number of breaks	<i>TODO Discuss</i>
C18	Every team must have exactly k number of breaks	<i>TODO Discuss</i>
C19	There must be at least k rounds between two games with the same opponents	$\forall t, t' : \exists j, k : t \neq t' \wedge MD[i][t][t'] = 1 \wedge MD[j][t'][t] = 1 \wedge i - j \geq k$
C20	There must be at most k rounds between two games with the same opponents	$\forall t, t' : \exists j, k : t \neq t' \wedge MD[i][t][t'] = 1 \wedge MD[j][t'][t] = 1 \wedge i - j \leq k$
C21	There must be at least k rounds between two games involving team t1 and any team from the subset S t2, t3,...	$\forall i : t_i \in S$
C22	Two teams play against each other in turn at home and away in 3RR or more	
C23	Team t wishes to play at least m1 and at most m2 home games on weekday1, m3-m4 on weekday2 and so on	<i>Requires 4th dim</i>
C24	Game h-team against a-team cannot be played before round r	$\exists d : MD[d][h][a] = 1 \wedge (d > r)$

C25	Game h-team against a-team cannot be played after round r	$\exists d : MD[d][h][a] = 1 \wedge (d < r)$
C26	The difference between the number of played home and away games for each team must not be larger than k in any stage of the tournament (a k-balanced schedule)	$\forall t, x \leq nd :  \sum_{i=0}^x SumHomerow(x, t) - \sum_{i=0}^x SumAwayrow(x, t)  \leq k$
C27	The difference in the number of played games between the teams must not be larger than k in any stage of the tournament (in a relaxed schedule)	$\forall t, t' : t \neq t'$
C28	Teams should not play more than k consecutive games against opponents in the same strength group	
C29	Teams should not play more than k consecutive games against opponents in the strength group s	
C30	At most m teams in strength group s should have a home game in round r	
C31	There should be at most m games between the teams in strength group s between rounds r1 and r2	
C32	Team t should play at least m1 and at most m2 home games against opponents in strength group s between rounds r1 and r2	
C33	Team t should play at least m1 and at most m2 games against opponents in strength group s between rounds r1 and r2	
C34	Game $t_i$ -team against $t_j$ -team can only be carried out in a subset of rounds $R = [r_1, r_2, r_3, \dots]$	$MD[d][i][j] = 1 \Rightarrow d \in R$
C35	A break of type A/H for team t1 must occur between rounds r1 and r2	
C36	The carry-over effects value must not be larger than c	