1 General Infromation

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

If compact scheme:

$$nt > 1$$

$$nd = (nt - 1) * 2\ if\ nt \,\%\, 2 = 0$$

$$nd = nt * 2\ if\ nt \,\%\, 2 = 1$$

2 Used operators

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

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

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

$$Max(val[]) \ = elementwiththehighestvalueinthearray$$

$$Min(val[]) \ = elementwiththelowestvalueinthearray$$

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 $t_1, t_2, ...$ 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 preassigned 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	*TODO Discuss*
C16	The total number of breaks per team must not be larger than k	*TODO Discuss*
C17	Every team must have an even number of breaks	*TODO Discuss*
C18	Every team must have exactly k number of breaks	*TODO Discuss*
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 t_a and any team from the subset S t2, t3,...	*Discuss*
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	*Requires 4th dim*
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)	$\forall t, x \leq nd : \lvert \sum_{i=0}^{x} SumHomerow(x,t) - \sum_{i=0}^{x} SumAwayrow(x,t) \rvert \leq k$
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)	$\forall d \leq nd : MAX(\forall t : \sum_{i=0}^{d} SumHomeRow(i,t) + SumAwayRow(i,t)) - MIN(\forall t : \sum_{i=0}^{d} SumHomeRow(i,t) + SumAwayRow(i,t)) \leq k :$
C28	Teams should not play more than k consecutive games against opponents in the same strength group	*Discuss*
C29	Teams should not play more than k consecutive games against opponents in the strength group s	*Discuss*
C30	At most m teams in strength group s should have a home game in round r	$\sum \forall s \in S : SumHomerow(r,s) \leq m$
C31	There should be at most m games between the teams in strength group s between rounds r1 and r2	$\sum(\forall s, s' \in S \wedge s \neq s' : (\sum_{i=r_1}^{r_2} MD[i][s][s']) \leq m$
C32	Team t should play at least m_1 and at most m_2 home games against opponents in strength group S between rounds r1 and r2	$m_1 \leq \sum \forall s \in S : \sum_{i=r_1}^{r_2} MD[i][t][s] \leq m_2$
C33	Team t should play at least m1 and at most m2 games against opponents in strength group s between rounds r1 and r2	$m_1 \leq \sum \forall s \in S : \sum_{i=r_1}^{r_2} MD[i][t][s] + MD[t][i][s] \leq m_2$

C34	Game t_i-team against t_j-team can only be carried out in a subset of rounds R= $[r_1, r_2, r_3, ...]$	$MD[d][i][j] = 1 => d \in R$
C35	A break of type A/H for team t1 must occur between rounds r1 and r2	*Discuss*
C36	The carry-over effects value must not be larger than c	*Discuss*