# Model Creation.

## Creating variables

Let $T$ be the set of colleges in GNAC conference (soccer)
Let $G$ be sexes for a team. [Men's, Women's]
Let $D$ be playable dates available.
Let $T_m := T \setminus \{SMU\}$, set of Men's team that doesn't include Simmons

for each $t \in T, g \in G$, we define $T_{t,g}$ be a set of specific teams $t$ has team of sex $g$ has to play at one point in the season.

Let $w(d)$ to be numeric value of day of the week that $D$ lands on
[i.e. 3 for Tuesday, 4 for Wednesday, 7 for Saturday]

for all $t_1 \in T_m, d \in D, t_2 \in T_{t_1, \text{Men's}}$

we define

$$x_{t_1,t_2,d,w(d),\text{Men's}} = \begin{cases} 1 & \text{if men's } t_1 \text{ hosts } t_2 \text{ on } d \text{ date} \\ 0 & \text{otherwise} \end{cases}$$

$$x_{t_2,t_1,d,w(d),\text{Men's}} = \begin{cases} 1 & \text{if men's } t_2 \text{ hosts } t_1 \text{ on } d \text{ date} \\ 0 & \text{otherwise} \end{cases}$$

for all $t_1 \in T, d \in D, t_2 \in T_{t_1,\text{Women's}}$

we define

$$x_{t_1,t_2,d,w(d),\text{Women's}} = \begin{cases} 1 & \text{if women's } t_1 \text{ hosts } t_2 \text{ on } d \text{ date} \\ 0 & \text{otherwise} \end{cases}$$

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Constraints

1

ⓐ Balancing Home & Away games for Women's team

For each women's team, we wants to balance the home and away games so that there won't be an overload of home or away games We make it to be greater than or equal to 5 games for ~~each~~both home and away ~~so that~~ since total games played will be 13 games per season. Each team will have $\geq 5$ and $\leq 7$ games ~~pe~~ either home or away per season.

for all $t_1 \in T, g \in G$;

$$\sum_{d \in D} \sum_{t_2 \in T_{t_1, women's}} x_{t_1, t_2, d, w(d), women's} \geq 5. \text{ (home games)}$$

~~for~~

$$\sum_{d \in D} \sum_{t_2 \in T_{t_1, women's}} x_{t_2, t_1, d, w(d), women's} \geq 5 \text{ (away games)}$$

~~for all~~

ⓑ Balancing for men's team

It will be the same for men's teams, who will play 12 games per season. Each team will have $\geq 5$ ~~and~~ or $\leq 6$ away or home games per season.

for all $t_1 \in T_m, g \in G$:

$$\sum_{d \in D} \sum_{t_2 \in T_{t_1, Men's}} x_{t_1, t_2, d, w(d), men's} \geq 5 \text{ (home games)}$$

$$\sum_{d \in D} \sum_{t_2 \in T_{t_1, men's}} x_{t_2, t_1, d, w(d), men's} \geq 5 \text{ (away games)}$$

(2) Each team should only play once per available playdate

~~(a) Women's teams~~

~~Since GNAC soccer teams only play once with another an opponent once per season, we make sure that~~

We make sure that each team play only once on a date either home or away.

~~for all $t_1 \in T$~~

(a) Women's teams

for all $t_1 \in T, d \in D, g \in G$:

$$\sum_{t_2 \in T_{t_1, Women's}} x_{t_1, t_2, d, w(d), Women's} + x_{t_2, t_1, d, w(d), Women's} \leq 1$$

(b) Men's teams

for all $t_1 \in T_m, d \in D, g \in G$:

$$\sum_{t_2 \in T_{t_1, Men's}} x_{t_1, t_2, d, w(d), Men's} + x_{t_2, t_1, d, w(d), Men's} \leq 1$$

(3) A team should only play once with a specific opponent either home or away in a season.

Since GNAC soccer teams only play once with ~~an~~ opponent once per season, we make sure that ~~for~~ it only happens once on a date in the season.

(a) for women's team,

for all $t_1 \in T, t_2 \in T_{t_1, Women's}, g \in G$:

$$\sum_{d \in D} x_{t_1, t_2, d, w(d), Women's} + x_{t_2, t_1, d, w(d), Women's} = 1$$

(b) for men's team

for all $t_1 \in T_m$, $t_2 \in T_{t_1,mens}$, $g \in G_s$

$$\sum_{d \in D} x_{t_1,t_2,d,w(d),mens} + x_{t_2,t_1,d,w(d),mens} = 1$$

(4) No more than three consecutive home games per season.

~~By Com. 6~~

Per GNAC comissioner request, we make sure that the team don't play at home for no more than three games

(a) ~~for~~ Men's team.

for all $t_1 \in T_m$, $g \in G$:

$$\sum_{d \in [d_k, d_{k+1}, d_{k+2}, d_{k+3}]} \sum_{t_2 \in T_{t_1,mens}} x_{t_1,t_2,d,w(d),Mens} \leq 3$$

(b) for Women's team

for all $t_1 \in T$, $g \in G$:

$$\sum_{d \in [d_k, d_{k+1}, d_{k+2}, d_{k+3}]} \sum_{t_2 \in T_{t_1,womens}} x_{t_1,t_2,d,w(d),womens} \leq 3$$

(5) No more than three away games consecutively per season.

The same reason as above.

(a) for Men's team:

for all $t_1 \in T_m, g \in G$:

$$\sum_{d \in [d_k, d_{k+1}, d_{k+2}, d_{k+3}]} \sum_{t_2 \in T_{t_1,Men's}} x_{t_2,t_1,d,w(d),Men's} \leq 3$$

(b) for women's teams

for all $t_1 \in T$, $g \in G$:

$$\sum_{d \in [d_k, d_{k+1}, d_{k+2}, d_{k+3}]} \sum_{t_2 \in T_{t_1,Women's}} x_{t_2,t_1,d,w(d),Women's} \leq 3$$

(6) Men's teams only play 12 games pe season either away or home.

for all $t_1 \in T_m, g \in G$:

$$\sum_{d \in D} \sum_{t_2 \in T_{t_1,Men's}} x_{t_1,t_2,d,w(d),Men's} + x_{t_2,t_1,d,w(d),Men's} = 12$$

(7) Women's teams only play 13 games per season either away or home.

for all $t_1 \in T, g \in G$:

$$\sum_{d \in D} \sum_{t_2 \in T_{t_1,Women's}} x_{t_1,t_2,d,w(d),Women's} + x_{t_2,t_1,d,w(d),Women's} = 13$$

$$\_\_\_\_\_ \times \_\_\_\_\_$$