

FinalModel

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Our final March Madness model with ad-hoc constraints included from part H.

Objective

Maximize expected number of points awarded based off a team's win probability.

Decision Variables

$$x_{ik} = \begin{cases} 1 & \text{if team } i \text{ wins round } k, \\ 0 & \text{o/w} \end{cases}$$

$$p_{ik} = \text{probability that team } i \text{ wins round } k \quad \forall i \in [0, 63], k \in [0, 5]$$

Objective Function

$$\max \sum_{k=0}^5 (2^k \sum_{i=0}^{63} p_{ik} x_{ik})$$

Constraints

$$\sum_{k=n}^5 x_{ik} \leq (6-n)x_{i,n-1} \quad \forall i \in [0, 63], n \in [1, 5] \quad \text{cannot win future rounds if loss in previous round}$$

$$\sum_{a=0}^1 x_{2p+a,0} = 1 \quad \forall p \in [0, 31] \quad \text{winners for Round of 64}$$

$$\sum_{a=0}^3 x_{4p+a,1} = 1 \quad \forall p \in [0, 15] \quad \text{winners for Round of 32}$$

$$\sum_{a=0}^7 x_{8p+a,2} = 1 \quad \forall p \in [0, 7] \quad \text{winners for Sweet Sixteen}$$

$$\sum_{a=0}^{15} x_{16p+a,3} = 1 \quad \forall p \in [0, 3] \quad \text{winners for Elite Eight}$$

$$\sum_{a=0}^{31} x_{32p+a,4} = 1 \quad \forall p \in [0, 1] \quad \text{winners for Final Four}$$

$$\sum_{i=0}^{63} x_{i,5} = 1 \quad \text{winners for Championship Game}$$

$x_{5,0} + x_{21,0} + x_{37,0} + x_{53,0} \geq 1$	guarantees an upset in first round between a 5 and 12 seed
$x_{9,0} + x_{25,0} + x_{41,0} + x_{57,0} \geq 1$	guarantees an upset in first round between a 6 and 11 seed
$x_{13,0} + x_{29,0} + x_{45,0} + x_{61,0} \geq 1$	guarantees an upset in first round between a 7 and 10 seed
$x_{3,0} + x_{19,0} + x_{35,0} + x_{51,0} \geq 2$	guarantees two upsets in first round between a 8 and 9 seed
$x_{0,3} + x_{15,3} + x_{31,3} + x_{47,3} \leq 3$	guarantees that at most 3 1-seed teams make the Final Four