Problem Set 4

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1. Suppose the player in the center prefer the opposite sides, the players around prefer the same sides. Then the player in the center choose strategy $\left(\frac{1+\epsilon}{2}H, \left(\frac{1-\epsilon}{2}T\right)\right.$ and the players around choose stratege $\left(\frac{1}{2}H, \frac{1}{2}T\right)$, the player in the center has reached his best response, which with utility 0. Now consider any other player, his best response is $(1H, 0T)$, the expected utility of which is ϵ, and his current expected utility is 0. Then we can conclude this is an ϵ-NE.

2. First we consider the five players around. For each one of them, let's call him A, suppose the center player's strategy is (pH, qT). If $p = q$, then any strategy for A is a best response. If $p > q$, then A's best response is $(1H, 0T)$. If $p < q$, A's best response is $(0H, 1T)$.

   Next consider the center player. His utility can be calculated by $p(\sum H_i - \sum T_i) + q(\sum T_i - \sum H_i)$. If $q = p$, it is a NE if and only if $\sum H_i = \sum T_i$. If $p > q$, his opponents will all choose $(1H, 0T)$, and the center players best response is $(0H, 1T)$, that is a contradiction. For $p < q$ is the same.

   Finally, we can conclude that all the NE are look like this: the center player's strategy is $\left(\frac{1}{2}H, \frac{1}{2}T\right)$, other players can choose arbitrary strategy as long as $\sum H_i = \sum T_i$.

3.