Sp19TopicalReviewProbability

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1 Probability

Since we are in the midst of the NBA postseason, let's use sampling to assemble the best NBA roster of 12 players. The teams still playing in the NBA playoffs listed in no particular order of greatness as of May 7, 2019 are the Golden State Warriors, Milwaukee Bucks, Toronto Raptors, Philadelphia 76ers, Portland Trail Blazers, Denver Nuggets, and the Houston Rockets. Each of these 7 teams have 12 active players on their roster and thus, there are a total of 84 players still playing. For the sake of this question, assume that each team has 3 point guards (PG), 3 shooting guards (SG), 2 small forwards (SF), 2 power forwards (PF) and 2 centers (C).

1. Let's say we are interested in assembling our best NBA roster of 12 players from one of the NBA teams listed above at random (obviously, we would choose the Golden State Warriors, but to give the rest of the NBA a "fair chance", let's sample randomly). Which sampling strategy would we use to achieve this goal?

Cluster sampling, each team is a cluster and then we do SRS to choose one team

2. Using the above sampling strategy from number 1, what is the probability that we choose all Golden State Warriors players to comprise our best NBA roster?

$1/7$

3. Now, although I don't agree, Suraj tells me that we need to be "fair" to all NBA teams. However, we do agree that we should only include players from 6 of the 7 NBA teams listed above (we won't include players from the Houston Rockets, nothing against them, just want to make the math easier). Now, suppose we are using stratified sampling with the strata being the other 6 NBA teams excluding the Rockets and within each strata, we sample 2 players at random without replacement to comprise our best NBA roster of 12 players. What is the probability that our best NBA roster will consist of all point guards (PG)?

3 PG for every team, 12 players

$P(\text{Warriors PGs}) = \frac{3}{12} \cdot \frac{2}{11}$

$P(\text{Bucks PGs}) = \frac{3}{12} \cdot \frac{2}{11}$

$\vdots$

$$\boxed{P(\text{all\_PG}) = \left(\frac{3}{12} \cdot \frac{2}{11}\right)^6}$$

4. Now, we are getting closer, but we want a variety of positions on our NBA roster. Now, just for the sake of simplicity, let's assume we are doing stratified sampling again, as above, but now, we sample a variety of players from each strata. We want to have 3 PG, 3 SG, 2 SF, 2 PF, and 2 C on our best NBA roster. From the Bucks, we want 1 C and 1 PF. From the Warriors, we want 1 PG and 1 SG. From the Raptors, we want 1 SG and 1 SF. From the 76ers, we want 1 C and 1 PG. From the Trail Blazers, we want 1 PG and 1 SG. From the Nuggets, we want 1 SF and 1 PF. What is the probability that we obtain this sample using stratified sampling?

3 PG
3 SG
2 SF
2 PF
2 C

every team

P(sample_cond) = stuff to right multiplied together

$P(\text{bucks\_cond}) = \frac{2}{12} \cdot \frac{2}{11}$

$P(\text{Warriors\_cond}) = \frac{3}{12} \cdot \frac{3}{11}$

$P(\text{Raptors\_cond}) = \frac{3}{12} \cdot \frac{2}{11}$

$P(\text{76ers\_cond}) = \frac{2}{12} \cdot \frac{3}{11}$

$P(\text{TB\_cond}) = \frac{3}{12} \cdot \frac{3}{11}$

$P(\text{Nuggets\_cond}) = \frac{2}{12} \cdot \frac{2}{11}$