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Create Problems based off the dataset for all sections covered in class

**Section 2.3**

A set of NBA teams S consist of (MIA, MIL, NOP, TOT, CLE, ORL, POR, NYK). Subset A = (MIA, NOP, TOT, CLE, ORL). Subset B = (MIA, MIL, NOP, POR, NYK, ORL)

1. List the elements of A ∩ B, A ∪ B, A - B

A ∩ B = (MIA, NOP, ORL) A ∪ B = (MIA, MIL, NOP, TOT, CLE, ORL, POR, NYK) A - B = (NOP, TOT, CLE)

1. List the elements of A ∩ !B and !A ∩ B

A ∩ !B = (TOT, CLE) !A ∩ B = (MIL, POR, NYK)

**Section 2.4**

A sample space consists of 5 events, each for the probability that a Kevin Durant is randomly guessed to play a certain position. If P(E1) = P(E2) = 0.24, P(E3) = 0.16, P(E4) = 2P(E5), what is P(E4) and P(E5)?

P(E4) = 0.24, P(E5) = 0.12

**Section 2.5**

The odds are three to one that when the Phoenix Suns and the Boston Celtics play, the Celtics win. If they play two games, what is the probability that the Suns win at least one game?

E1: SS, E2: SC, E3: CS, E4: CC

P(E1) = 1/9. P(E2) = 2/9, P(E3) = 2/9, P(E4) = 4/9

P(S) = P(E1) + P(E2) + P(E3) = 1/9 + 2/9 + 2/9 = 5/9

**Section 2.6**

A study is to be conducted to determine the attitudes of basketball players toward various coaching methods. A sample of 10 players is to be selected from a total of the 50 players from the 2021 season

1. How many different samples of 10 players can be selected?

50C10 = 10272278170

1. Twenty of the 50 nurses are older than 28. If 10 nurses are randomly selected from those employed by the hospital, what is the probability that the sample of ten will include exactly 4 older than 28 and 6 28 or younger players?

20C4 \* 30C6 / 50C10 = 0.28

**Section 2.7**

| 3 Point Attempt Rate | Age 28 + (O) | Age < 28 (Y) | Total |
| --- | --- | --- | --- |
| >= 0.5 (A) | 61 | 122 | 183 |
| < 0.5 (!A) | 197 | 117 | 314 |
| Total | 258 | 239 | 497 |

Are the events A and Y independent

P(Y|A) = 122/183 = 2/3 P(Y) = 239/497 A and Y are dependent

Are the events !A and O independent

P(O|!A) = 197/314 P(O) = 258/497 !A and O are dependent

**Section 2.8**

Two independent events, a successful assist, and a successful steal have probabilities such that P(A) = .4 and P(S) = .2, Find P(A U S) and P(!A∩S)

P(A U S) = P(A) + P(S) - P(A∩S) = .4 + .2 - (.4\*.2) = 0.68

P(!A∩S) = P(!A)\*P(S) = 0.6 \* 0.2 = 0.12

**Section 2.9**

NBA player Dwight Howard has a total rebound rate of 25.3%, and takes 4 opportunities to try and rebound the ball during a game. If the attempts are independent, what is the probability that he gets all 6 rebounds?

(0.253)^4 = 0.004, or 0.4%

**Section 2.10**

A population of players contains 30.7% players over the age of 27 and 69.3% under the age of 28. Of the players over 27, 25% wish to play for the Los Angeles Lakers, and 68% of the players under 28 do as well. A player chosen at random is found to wish to play for the Lakers. Find the conditional probability that this player is under the age of 28.

A= wish to play for lakers. B1 = Over 27, B2 = Under 28

P(A) = P(A|B1)P(B1) + P(A|B2)P(B2) = .25 \* .307 + .68 \* .693 = 0.55

P(B2|A) = (.68 \* .693) / 0.55 = 0.86

**Section 3.2**

Players are assigned to 3 random positions by random people. Find the probability distribution for Y, the number of correct matches of players to their actual positions

(y=0) = 2/6 p(0) = 1/3

(y=1) = 3/6 p(1) = 1/2

(y=2) = 0/6 p(2) = 0

(y=3) = 1/6 p(3) = 1/6

**Section 3.3**

Find the expected and variance for the table of different players 3 point Attempt rate

| y | p(y) |
| --- | --- |
| 0 | 0.482 |
| 1 | 0.151 |
| 2 | 0.278 |
| 3 | 0.089 |

E(Y) =

**Section 3.4**

Player Kostas Antetokounmpo has a block rate of 21.3%. What is the probability that he is successful in 5 out of 10 block attempts.

p(5) = 10C5 \* 0.213^5 \* 0.787^(10-5) = 252 \* 0.000438 \* 0.302 = 0.0333 or 3.33%

**Section 3.5**

Player Josh Green has a free throw attempt rate of 0.306.

1. What is the probability that the 3rd free throw is the first successful attempt.

p(X=3) = (1-0.306)^(3-1) \* 0.306 = 0.147

1. What is the expected and variance?

μ = 1/0.306 = 3.27 σ^2 = (1-p)/p^2 = (1-.306)/(.306)^2 = 7.411

**Section 3.7**

A team of 12 is selected from a population of 40 NBA players. The population contains 10 of the best players in the NBA. What is the probability that the team contains 5 of the best players.

N = 40 n = 12 r = 10 y= 5

p(5) = 10C5 \* (40-10)C(12-5) / 40C12 = 252 \* 2035800 / 5586853480 = 0.0918 or 9.18%

**Section 3.8**

A win share is a measure that is assigned to players based on their offense, defense, and playing time. One win share is worth one-third of a team win. Joel Embiid has a win shares per 48 minutes rate of 0.273. What is the probability that in 10 games, Joel earns 3 win shares.

P(Y=3) = (λ^y / y!) \* e^-λ = .273^3 / 3! \* e^-.273 = 0.00258

**Section 3.11**

The number of games played across all players in the 2021 NBA season has a mean of 18.46 and a standard deviation of 8.31. What is the probability that next season will have a mean of more than 15 but less than 22?

P(15 < Y < 22) >= 1- 1/k^2 = 1 - 1/8.31 = 0.8797

**Section 4.2**

The number of games all NBA players have played in individually can be represented by

1. Find F(y)

1. Find P(10<=Y<=25)

|2510 = 312.5 - 50 = 262.5

**Section 4.3**

Find the expected for the density function representing the player's ages.

E(Y) = 3719 = 14598

**Section 4.4**

A player’s player efficiency rating is uniformly distributed over the course of a game, 48 minutes. What is the probability that the player efficiency rating increases over the last 12 minutes?

**Section 5.2**

Suppose that the ball is randomly located in a square on the court with sides of unit length. Let X and Y denote the coordinates of the ball's position.

Find F(0.3, 0.8)

**Section 5.3**

From a group of three players with a player efficiency rating over 25, two with a rating between 25 and 20, and three with a rating below 20. Form a group of two that will go in a head to head match against each other. What is the probability for each combination to have players from the over 25 and between 25 and 20 group, where X is the players between 25 and 20, and Y is the players over 25

|  |  | X |  |  |
| --- | --- | --- | --- | --- |
| Y | 0 | 1 | 2 | Total |
| 0 | 1/7 | 2/7 | 1/21 | 10/21 |
| 1 | 3/7 | 2/7 | 0 | 5/7 |
| 2 | 1/7 | 0 | 0 | 1/7 |
| Total | 5/7 | 4/7 | 1/21 | 4/3 |

p1(1) = 4/7 and p1(2) = 1/21

**Section 5.4**

Use the probabilities found in the previous question of player efficiencies, to determine whether X and Y are independent for (0,0), (0,1),(0,2),(1,0),(1,1), and (2,0)

(0,0) = p1(0) \* p2(0) 1/7 =/= 5/7 \* 10/21 Dependent

(0,1) = p1(0) \* p2(1) 3/7 =/= 5/7 \*5/7 Dependent

(0,2) = p1(0) \* p2(2) 1/7 =/= 5/7 \* 1/7 Dependent

(1,0) = p1(1) \* p2(0) 2/7 =/= 4/7 \* 10/21 Dependent

(1,1) = p1(1) \* p2(1) 2/7 =/= 4/7 \* 5/7 Dependent

(2,0) = p1(2) \* p2(0) 1/21 =/= 10/21 \* 1/21 Dependent