COMP2804 – Winter 2020 – Assignment 3 – Andy Chia – 101111058

**Probability of scrabble words**

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| 1. |  | *A scrabble hand is a set of 7 tiles, each having one of the English uppercase letters on them, drawn uniformly at random from a bag of 100 tiles. The number of tiles of each letter are as follows:*  *E×12, A×9, I×9, O×8, N×6, R×6, T×6, L×4, S×4, U×4, D×4, G×3, B×2, C×2, M×2, P×2, F×2, H×2, V×2, W×2, Y×2, K×1, J×1, X×1, Q×1, Z×1* |
|  | 1. | *What is the probability that a scrabble hand contains the word “HEXAGON”?*   |  |  |  |  | | --- | --- | --- | --- | |  | Amount Needed | Amount Of the letter | # of subsets | | H | 1 | 2 |  | | E | 1 | 12 |  | | X | 1 | 1 |  | | A | 1 | 9 |  | | G | 1 | 3 |  | | O | 1 | 8 |  | | N | 1 | 6 |  |   Since the word is 7 characters long, we don’t have to add the chance of getting missing characters that wasn’t picked  \*After removing a letter from the bag, we must lower the count of tiles in the bag  \*Starting tile pulled can be any of the pool (HEXAGON)  Number of subsets for the word HEXAGON:  The 7 tiles can be arranged in 7! ways:  7-permutatuons of 100  P(HEXAGON) =  Note: |
|  | 2. | *What is the probability that a scrabble hand contains the word GARBAGE?*   |  |  |  |  | | --- | --- | --- | --- | |  | Amount Needed | Amount Of the letter | # of subsets | | G | 2 | 3 |  | | A | 2 | 9 |  | | R | 1 | 6 |  | | B | 1 | 2 |  | | E | 1 | 12 |  |   Number of subsets for the word HEXAGON:  The 7 tiles can be arranged in 7! ways:  7-permutatuons of 100  P(GARBAGE) =  Note: |
|  | 3. | *What is the probability that a scrabble hand contains the word APPLE?*   |  |  |  |  | | --- | --- | --- | --- | |  | Amount Needed | Amount Of the letter | # of subsets | | A | 1 | 9 |  | | P | 2 | 2 |  | | L | 1 | 4 |  | | E | 1 | 12 |  |   Number of subsets for the word APPLE:  The 4 tiles can be arranged in 4! ways:  4-permutatuons of 100  P(GARBAGE) =  Note: |

**Feeding Your Rat**

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| 2. |  | A rat feeder is essentially a straw whose diameter is just large enough for 1 (medicine) pill or 1 (food) pellet but is long enough to hold many pills and pellets. The pill and pellets are put in at one of the feeders and come out the other end (when the rat presses a pedal) in the same order they were put in.  Suppose we place 25 identical pellets and 4 identical pills uniformly at random into a rat feeder. The rat then comes and consumes one item x1 from the feeder and then consumes another item x2 from the feeder. |
|  | 1. | Let A be the event "x1 is a pellet" and let B be the event "x2 is a pill". |
|  | 2. | What is Pr(A∩B)?  Pr(A∩B) = Pr(A) \* Pr(A|B)   * First item consumed must be a pellet * Second item consumed must be a pill   Pr(A) = 25/29  If A is true, then we can pass to test B  Pr(A|B) = 4/28  Pr(A∩B = Pr(A) \* Pr(A|B) = 25/29 \* 4/28 = 100/812 = 25/203 |
|  | 3. | What is Pr(A∪B)?   * At least one of the two items consumed must follow A and B   Pr(A∪B) = Pr(A) + Pr(B) – Pr(A∩B) = 25/29 + 4/28 – 25/203 ≈ 0.88177339 |
|  | 4. | Are the events A and B independent? In other words, is Pr(A∩B)=Pr(A)⋅Pr(B)?  No Events A and B are not independent because after removing one of the items, the probability changes because there is one less item in the feeder |

**A Coin-Flipping Game**

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| 3. |  | *Consider the following coin tossing games. For each one, compute the probability that you win the game. For each question, the answer is a rational number so you should give this number exactly and give a decimal approximation of it as well.* |
|  | 1. | You toss a fair coin twice and win if it comes up heads at least once.  2 Possibilities | 2 actions | Heads at least once  A = If the first coin flips lands on head  B = If the second coin flipped lands on head  Pr(A∩B) = Pr(A) \* Pr(B) = 0.5 \* 0.5 = 0.25  Pr(A∪B) = Pr(A) + Pr(B) – Pr(A∩B) = 0.5 + 0.5 – 0.25 = 0.75 |
|  | 2. | You toss a fair coin 10 times and win if comes up heads at least five times.  2 Possibilities | 10 Actions | Heads at least 5 times |
|  | 3. | You toss a fair coin twice and win if it comes up heads exactly once.  2 Possibilities | 2 Actions | Heads once |
|  | 4. | You toss a fair coin 10 times and win if comes up heads exactly five times.  2 Possibilities | 10 Actions | Heads exactly 5 times |