Probability Dec 2019 (No Calculators)

3 pts 1. Studies have shown that each student leaving a high school has a 2/3 probability of stepping out the door left foot first and a 1/3 probability of stepping out right foot first. Find the probability the first 3 students to leave tomorrow will step right foot first and the fourth student will step out left foot first.

Ans. ____________

4 pts 2. Kayla owns 6 different pairs of shoes. One day she reaches into the bottom of her closet in the dark and randomly selects 4 individual shoes out of the 12 individual shoes she keeps there. Find the probability Kayla will select at least one complete pair.

Ans. ____________

5 pts 3. Bingo the cat is happy 3/5 of the days and sad 2/5 of the days, independently. Find the probability Bingo will be happy at least 3 of the next 5 days.

Ans. ____________

Solutions – Probability

1. $\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{1}{3}\cdot\frac{2}{3}=\frac{2}{81}$. **Ans. 2/81**

2. We need to find the probability that she will select no complete pair and subtract from 1.

1st can be any; 2nd must be 10 of the remaining 11; 3rd must be any 8 of the remaining 10; 4th must be 6 of the remaining 9. $1\cdot\frac{10}{11}\cdot\frac{8}{10}\cdot\frac{6}{9}=\frac{16}{33}$. $1-\frac{16}{33}=\frac{17}{33}$. **Ans. 17/33**

3. 3 happy days: $\binom{5}{3}\left(\frac{3}{5}\right)^3\left(\frac{2}{5}\right)^2=\frac{10\cdot 27\cdot 4}{5^5}=\frac{1080}{3125}$. 4 happy days: $\binom{5}{4}\left(\frac{3}{5}\right)^4\left(\frac{2}{5}\right)^1=\frac{5\cdot 81\cdot 2}{5^5}=\frac{810}{3125}$.

5 happy days: $\binom{5}{5}\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^0=\frac{1\cdot 243\cdot 1}{5^5}=\frac{243}{3125}$. Sum is $\frac{2133}{3125}$. **Ans.2133/3125**

1 Probability Dec 2018 (No Calculators)

3 pts 1. Two dice are tossed. What is the probability that the sum on the top faces is a 6, 7, or 8?

Ans.____________________

4 pts 2. Three chips are chosen at random from a box containing 5 red, 6 white and 7 blue chips. What is the probability that they are all the same color?

Ans. ____________________

5 pts 3. Katie loves fruit. There are 6 apples, 5 bananas and 4 oranges in the fruit basket at home. What is the probability that if she randomly chooses 5 fruit to take to school to snack on, that she gets 2 apples, 2 bananas and one orange?

Ans. ____________________

Solutions - Probability

1. There are 5 ways to get a 6, 6 ways a 7, and 5 to get an 8, out of 36. 16/36 = 4/9. **Ans. 4/9**

2. $P(3r) = \frac{{}_5C_3}{{}_{18}C_3} = \frac{10}{6\cdot17\cdot8}$. $P(3w) = \frac{{}_6C_3}{6\cdot17\cdot8} = \frac{20}{6\cdot17\cdot8}$. $P(3b) = \frac{{}_7C_3}{6\cdot17\cdot8} = \frac{35}{6\cdot17\cdot8}$. **Ans. 65/816**

3. $P(2a,5b,1or) = \frac{{}_6C_2\cdot{}_5C_2\cdot{}_4C_1}{{}_{15}C_5} = \frac{15\cdot10\cdot4}{3\cdot7\cdot13\cdot11} = \frac{5\cdot10\cdot4}{7\cdot13\cdot11} = \frac{200}{1001}$. **Ans. 200/1001**

1 Probability Dec 2017 (No Calculators)

3 pts 1. If three six-sided dice are rolled, and the number of dots on the top face of each die is multiplied, what is the probability that the product is an odd number?

Ans. ____________________

4 pts 2. Six schools are competing in a track meet. If each school enters three runners in the one mile run and if each runner is equally likely to come in first, second or third, what is the probability that the top three runners are from the same school?

Ans. ____________________

5 pts 3. A fair die is tossed four times. What is the probability that it lands with either a 5 or a 6 on the top face of at least one die?

Ans. ____________________

Solutions – Probability

1. The only way for the product of 3 numbers to be odd, is that all 3 numbers must be odd. Otherwise an even product would result. 1, 3, 5 are odd. Thus (1/2)(1/2)(1/2) = 1/8. **Ans. 1/8**

2. 18 runners, so there are ${}_{18}C_3$ possible winners. All three winners from one school would only be 1 way. Since there are 6 schools: $\frac{1}{{}_{18}C_3}(6) = \frac{6}{\frac{18\cdot 17\cdot 16}{3\cdot 2}} = \frac{6}{6\cdot 17\cdot 8} = \frac{1}{136}$. **Ans. 1/136**

3. At least once: 1 – not getting a 5 or a 6 ➔ $1-(2/3)^4 = 1 - 16/81 = 65/81$. **Ans. 65/81**

1 Probability Dec 2016-17 (No Calculators)

3 pts 1. If you draw a card at random from a regular deck of 52 playing cards, what is the probability that it is a jack, queen or king?

Ans. ____________________

4 pts 2. A student council of a certain school has 4 students from each class. The senior class has 2 boys and 2 girls. The junior class also has 2 boys and 2 girls. If two seniors and two juniors are chosen at random to represent the school at a student council event, what is the probability that 2 boys and 2 girls are chosen?

Ans. ____________________

5 pts 3. It has been determined that at a certain intersection, cars arriving from the west go straight ahead 10% of the time, turn left 70% of the time and turn right 20% of the time. It is also known that 80% of the drivers use their signals properly. You, who are heading into the intersection from the west, are in a car behind a driver who does not have his or her signal on. What is the probability that the driver will turn left?

Ans. ____________________

Solutions – Probability

1. 4 jacks, 4 queens, 4 kings out of 52 cards → 12/52 = 3/13. **Ans. 3/13**

2. The possible results are 2 senior boys and 2 junior girls, 2 senior girls and 2 junior boys, or a boy and a girl from each class. Thus: $\frac{2}{4}\cdot\frac{1}{3}\cdot\frac{2}{4}\cdot\frac{1}{3}+\frac{2}{4}\cdot\frac{1}{3}\cdot\frac{2}{4}\cdot\frac{1}{3}+\left(\frac{2}{4}\cdot\frac{2}{3}\right)\left(\frac{2}{4}\cdot\frac{2}{3}\right)=\frac{4(2+4)}{4\cdot3\cdot4\cdot3}=\frac{6}{36}$. **Ans.** ~~1/6~~ 1/2

3. If the person is turning left he must not have his signal light on (0.7)(0.2). All the possibilities that the driver could do are go left, go straight ahead, or turn right. Those are (0.7)(0.2) + 0.1 + (0.2)(0.2). Thus the probability he goes left is $\frac{(0.7)(0.2)}{(0.7)(0.2)+0.1+(0.2)(0.2)}=\frac{1}{2}$

Ans. 1/2

1 Probability Dec 2015 (No Calculators)

3 pts 1. Assuming that half the students at a high school are girls, find the probability the first student entering the cafeteria for lunch tomorrow at that school will be a girl, born on Friday and stepping into the cafeteria with her left foot.

Ans. ______________

4 pts 2. Each of the letters in the word PROBABILITY is written on a separate card, the cards are randomly mixed and three cards are drawn and placed on a table. Find the probability that two of the drawn cards on the table have the same letter written on them.

Ans. ______________

5 pts 3. There are 24 students in a class, where colors of clothing are noted as follows: 11 are wearing blue, 14 are wearing green, 1 is wearing red and green only, 3 are wearing blue and red only, 5 are wearing blue and green only, and 2 are wearing red, green and blue. If a person is chosen at random from the class, what is the probability that they have red clothing on?

Ans. ______________

Solutions – Probability

1. Product of three independent probabilities: $\frac{1}{2}\cdot\frac{1}{7}\cdot\frac{1}{2}=\frac{1}{28}$. **Ans. 1/28**

2. The total possible outcomes is ${}_{11}C_3 = 165$. 9 have two I's, and 9 have two B's.

Therefore 18/165, reduced 6/55. **Ans. 6/55**

$\angle BAC = \angle CAD = \angle DAE = \angle EAF = 30^\circ$ 3. If you make a Venn diagram, you will find that to make ~~24 people~~, then 6 are completely red and 6 are red and some other color. Total 12 out of 24.

Does not specify only colors are Red, Green, Blue. Any Thing from $\frac{6-12}{24}$. **Ans. 1/2**

1 **Probability** **Dec 2014** **(No Calculators)**

3 pts 1. On the toss of a pair of dice, what is the probability of getting a pair of numbers whose product is 12?

Ans. ____________

4 pts 2. Grandma Dote has 12 presents for her 4 grandsons, all in boxes. 3 of the presents are games and the rest are clothes and a variety of other things. She doesn't put names on the boxes and each grandson gets three presents. What is the probability that one of the grandsons gets all three of the games?

Ans. ________________

5 pts 3. Each of the letters A, B, C, D, and E are placed on separate cards. Each of the letters are then drawn randomly one at a time and placed side by side from left to right. What is the probability that no vowels are placed consecutively?

Ans. ________________

Solutions – Probability

1. 2(6), 6(2), 3(4), 4(3) are ways to get a product of 12. 4/36 = 1/9. **Ans. 1/9**

2. For a grandson to get all games: $\frac{3}{12} \cdot \frac{2}{11} \cdot \frac{1}{10} = \frac{1}{220}$. For all 4, 1/55. **Ans. 1/55**

3. All possible ways: 5(4)(3)(2)(1) = 120. For all ways that the vowels are together: Pretend the two are glued, so they only move as one in the group, thus 4! = 24, but those two can be switched. 2(24) = 48. (120 – 48)/120 = 72/120 = 3/5. **Ans. 3/5**

1 Probability Dec 2013 (No Calculators)

3 pts 1. There are 8 red, 7 white, 5 blue chips. A chip is chosen at random and then replaced. A second chip is then chosen. What is the probability that both are red?

Ans. ____________

4 pts 2. A positive integer, n, is picked at random from the integers 1 to 30 inclusive. What is the probability that the greatest common factor of n and 30 is greater than 1?

Ans. ____________

5 pts 3. Four people are selected at random. What is the probability that at least two of them were born on the same day of the week?

Ans. ____________

Solutions – Probability

1. $\text{r r} = \frac{8}{20}\cdot\frac{8}{20} = \frac{2}{5}\cdot\frac{2}{5} = \frac{4}{25}$ **Ans. 4/25**

2. The numbers 1 through 30 that do not have a GCF greater than one are 1, 7, 11, 13, 17, 19, 23, and 29. So 22 do. 22/30 = 11/15. **Ans. 11/15**

3. Let p = the probability that they were born on the same day of the week. Then there are 4 scenarios' of at least two of them. (1) only two, (2) three, (3) four, (4) two on one day and two others on a different day. You may want to consider the individuals as A, B, C, and D, especially on (4).

$$(1)\!: p\cdot p\cdot \not{p}\cdot \not{p}\binom{4}{2} + (2)\!: p\cdot p\cdot p\cdot \not{p}\binom{4}{1} + (3)\!: p\cdot p\cdot p\cdot p + (4)\!: p\cdot p\cdot d\cdot d\,(3)$$

$$1\cdot\frac{1}{7}\cdot\frac{6}{7}\cdot\frac{5}{7}(6) \quad + \quad 1\cdot\frac{1}{7}\cdot\frac{1}{7}\cdot\frac{6}{7}(4) \quad + \quad 1\cdot\frac{1}{7}\cdot\frac{1}{7}\cdot\frac{1}{7} \quad + \quad 1\cdot\frac{1}{7}\cdot\frac{6}{7}\cdot\frac{1}{7}(3) =$$

$$\frac{180+24+1+18}{343} = \frac{223}{343}$$ **Ans.** $\frac{223}{343}$

1 Probability Dec 2012 (No calculators)

3 pts 1. Max went to a house on Halloween, where there were 5 boxes each containing a different candy bar. They contained Snickers, Pay Day, Hershey's Milk Chocolate, Milky Way, and Kit Kat bars. Visitors could only take two bars, one from each of two boxes. Find the probability that Max took a Kit Kat bar and a Pay Day bar.

Ans. ____________________

4 pts 2. Celia was taking a course "The World About You". The course involved watching and critiquing movies. Among the possible selections were 6 history, 5 biography and 4 geography movies. Celia had to choose 8 of these. What is the probability that she chose 3 history, 3 biography and 2 geography movies?

Ans. ____________________

5 pts 3. In the game of Yahtzee one has a chance to get Yahtzee (5 of the same kind, such as 5 sixes) in the throw of 5 dice. One has three chances to produce the 5 of a kind by throwing the dice three times, picking up all or some for the next throw. Denton threw two fives in his first throw and left those. He picks the other three dice and proceeds. What is the probability that he gets a Yahtzee of fives?

Ans. ____________________

Solutions – Probability

1. Using S, P, H, M, K as letters for the bars. The possible choices are SP, SH, SM, SK, PH, PM, PK, HM, HK, MK. PK is one of the ten choices. **Ans. 1/10**

2. $\dfrac{{}_6C_3 \cdot {}_5C_3 \cdot {}_4C_2}{{}_{15}C_8} = \dfrac{20\cdot 10\cdot 6}{5\cdot 13\cdot 11\cdot 9} = \dfrac{4\cdot 10\cdot 2}{13\cdot 11\cdot 3} = \dfrac{80}{429}$ **Ans. 80/429**

3. If 3 5's in the next throw of the three dice: $\frac{1}{216}$. If two 5's come up and the last die has to be thrown for the last 5: $\frac{1}{6}\cdot\frac{1}{6}\cdot\frac{5}{6}\cdot 3\cdot\frac{1}{6} = \frac{15}{6^4}$. If one 5 comes up and the last two dice have to produce the other 2 5's: $\frac{1}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot 3\cdot\frac{1}{6}\cdot\frac{1}{6} = \frac{75}{6^5}$. If no 5's come up on the second throw and the 3 5's have to be thrown on the third throw: $\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{1}{6}\cdot\frac{1}{6}\cdot\frac{1}{6} = \frac{125}{6^6}$. Combining with common denominators: $\frac{125+216+540+450}{6^6} = \frac{1331}{6^6} = \frac{1331}{46{,}656}$ **Ans.** $\frac{1331}{46{,}656}$

1 Probability Dec 2011 (No Calculators)

3 pts 1. The probability 3 straight HEADS would be flipped with a particular unfair coin is $^{125}/_{512}$. Find the probability two straight TAILS would be flipped with this same coin.

Ans. ____________

4 pts 3. In the past 5 years Bill has tagged 3 deer during hunting season. Using this as a basis, we can assume his chances of tagging a deer each year is 3/5. What is the probability that he tags at least 3 deer in the next 5 seasons?

Ans. ____________

5 pts 2. The four entrees at MAML High School on a certain day were pizza, chicken nuggets, macaroni and cheese, and fish chowder. If Allen, Brian, and Carl each randomly choose an entrée, what is the probability that at least two of them choose the same entrée?

Ans. ____________

Solutions – Probability

1. $\frac{125}{512} = \left(\frac{5}{8}\right)^3$. P(HEADS) = 5/8. P(TAILS) = 3/8. $\left(\frac{3}{8}\right)^2 = 9/64$. **Ans. 9/64**

2. Tagging 3: $d \cdot d \cdot d \cdot \not{d} \cdot \not{d} \left(\frac{5!}{3!2!}\right) = \left(\frac{3}{5}\right)^3\left(\frac{2}{5}\right)^2(10) = \frac{3^3 \cdot 4 \cdot 10}{5^5}$

Tagging 4: $d \cdot d \cdot d \cdot d \cdot \not{d} \left(\frac{5!}{4!}\right) = \left(\frac{3}{5}\right)^4\left(\frac{2}{5}\right)(5) = \frac{3^4 \cdot 10}{5^5}$

Tagging 5: $d \cdot d \cdot d \cdot d \cdot d = \left(\frac{3}{5}\right)^5 = \frac{3^5}{5^5}$

Adding: $\frac{3^3(40+30+9)}{3125} = \frac{27 \cdot 79}{3125} = \frac{2133}{3125}$. **Ans.** $\frac{2133}{3125}$

3. If Allen chooses one of the entrees and Brian chooses the same, but Carl does not: 1(1/4)(3/4) = 3/16. Allen and Carl could have chosen the same and Brian did not, or Brian and Carl could have chosen the same and Allen did not: 3/16 times 3 = 9/16. If they all chose the same entrée, it would be 1/16. The sum is 10/16 or 5/8. **Ans. 5/8**

1 Probability (No Calculators) Dec 2010

3 pts 1. Of all the natural numbers less than 50, what is the probability of randomly selecting a number that contains only one "2"?

Ans. ________________

4 pts 2. There are 3 green socks, 4 brown socks and 2 white socks in a drawer. What is the probability of selecting socks of three different colors, if you take three socks out of the drawer at once?

Ans. ________________

5 pts 3. Two people, A and B, are selected at random. Find the probability the first letter in A's first name is a letter that appears in the alphabet before the first letter in B's first name. Assume an equal number of names begin with each of the 26 letters of the alphabet.

Ans. ________________

Solutions – Probability

1. The numbers having only one "2": 2, 12 ,20 ,21 ,23 ,24 ,25 ,26 ,27, 28 ,29 ,32 ,42 are 13 out of 49. **Ans. 13/49**

2. If choosing green and then brown and then white: $\frac{3}{9}\cdot\frac{4}{8}\cdot\frac{2}{7}$. Switching the choices is 3! $\frac{1}{21}\cdot 3! = \frac{2}{7}$. By combinations: $\frac{{}_3C_1\cdot{}_4C_1\cdot{}_2C_1}{{}_9C3} = \frac{3\cdot 4\cdot 2}{3\cdot 4\cdot 7} = \frac{2}{7}$. **Ans. 2/7**

3. Quickly: the probability of a match is 1/26. The probability of no match is 25/26. Half of the non-matches will be A first. $\frac{1}{2}\cdot\frac{25}{26} = \frac{25}{52}$. Slowly: $\frac{1}{26}\left(0+\frac{1}{26}+\frac{2}{26}+\cdots+\frac{25}{26}\right) = \frac{1}{26^2}(1+2+3+\cdots+25) = \frac{1}{26\cdot 26}\left(\frac{25\cdot 26}{2}\right) = \frac{25}{52}$. **Ans. 25/52**

1 Probability Dec 09 (No Calculators)

3 pts 1. A six-sided die has been altered so that the side that had been a single dot is now a blank zero-valued face. Another die has been altered to show a zero-valued face instead of the face with four dots. What is the probability that a sum of 7 is rolled when the two dice are thrown?

Ans. ____________________

4 pts 2. Megan is throwing a die and wants to get all six different outcomes. What is the probability, expressed as a fraction in lowest terms, that she succeeds in her first six rolls?

Ans. ____________________

5 pts 3. Bob and Betty are playing a game in which either player is equally likely to win any given point. Bob currently has four points and Betty has three points. If the object of the game is the first to get 7 points wins, what is the probability that Bob wins the game?

Ans. ________________________

Solutions – Probability

1. The first die has 0, 2, 3, 4, 5, 6 dots. The second has 1, 2, 3, 0, 5, 6. The sums to make 7 are (2, 5), (4, 3), (5, 2) and (6, 1). 4 out of 36. **Ans. 1/9**

2. Rolling each of the 6 has a probability of $1/6^6$. The order of all six is 6!. $6!/6^6$
$= \frac{1\cdot2\cdot3\cdot4\cdot5\cdot6}{6\cdot6\cdot6\cdot6\cdot6\cdot6} = \frac{4\cdot5}{6\cdot6\cdot6\cdot6} = \frac{5}{3\cdot3\cdot6\cdot6} = \frac{5}{324}$. **Ans. 5/324**

3. Bob has 4 points. Betty has 3 points. Consider Bob's victory points as b, and Betty's as t. Bob can win in 3 points: $(½)^3 = 1/8$. Bob could win if Betty gets one point and Bob gets 3: $btbb = \frac{1}{16}(3) = \frac{3}{16}$, since t could be in any of the first three positions. Bob could win if Betty gets 2 points: $bttbb = \frac{1}{32}\left(\frac{4!}{2!2!}\right) = \frac{3}{16}$. Then Bob could win if Betty only gets 3 points: $btttbb = \frac{1}{64}\left(\frac{5!}{3!2!}\right) = \frac{10}{64} = \frac{5}{32}$. $\frac{1}{8}+\frac{3}{16}+\frac{3}{16}+\frac{5}{32} = \frac{4+6+6+5}{32} = \frac{21}{32}$. In all four situations, b has to be in the last position, in order for Bob to win. **Ans. 21/32**