ASSIGNMENT-1

21MAT117 MATHEMATICS FOR INTELLIGENT SYSTEMS-II

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Submitted BY: -

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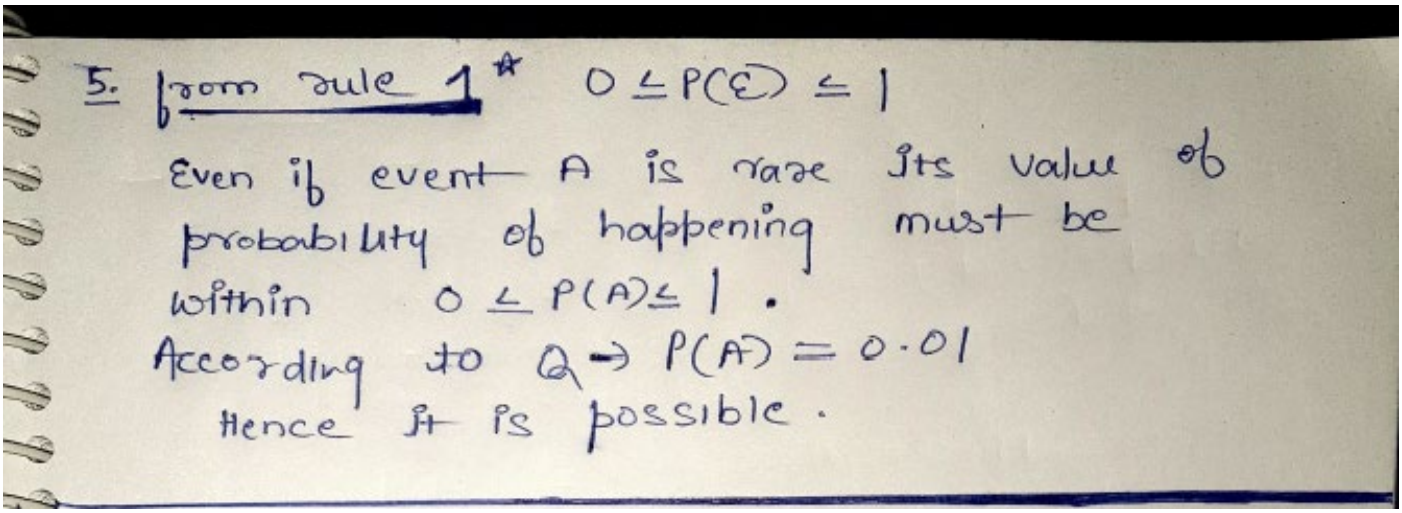
EXERCISE

For each of the following situations, state the probability rule or rules that you would use and apply it or them. Write a sentence explaining how the situation illustrates the use of the probability rules.

1. The probability of event A is 0.224. What is the probability that event A does not occur?
2. A coin is tossed three times. The probability of zero heads is 1/8 and the probability of zero tails is 1/8. What is the probability that all three tosses result in the same outcome?
3. With data from 2, what is the probability that there is at least one head and at least one tail?
4. The probability of event A is 0.5 and the probability of event B is 0.6. Events A and B are disjoint. Can this happen?
5. Event A is very rare. Its probability is 0.01. Can this happen?

Ans.



Exercise

1. $P(A) = 0.224$

from Rule 1 we know $0 \leq P(A) \leq 1$ *

from Rule 4, for any event $P(A^c) = 1 - P(A)$ *.

for a non occurence we use both of the above Rules

$$P(A^c) = 1 - 0.224 = 0.776$$

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2. A coin is tossed three times

All the possibility or Sample space is $2^3 = 8$

$S = [TTT, TTH, THT, THH, HHH, HHT, HTH, HTT]$

Probability of zero head $= \frac{1}{8}$
[TTT]

Probability of zero tails $= \frac{1}{8}$
[HHH]

Probability of all three result in same outcome
i.e [HHH, TTT]

$P(A) + P(B) = P(A \text{ or } B)$ {Disjoint Event Rule 3} *

$\frac{1}{8} + \frac{1}{8} = P(A \text{ or } B)$

$\frac{1}{4} = P(A \text{ or } B)$ * {Rule 1 $0 \leq P(A \text{ or } B) \leq 1$}

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3. Probability where there is atleast one one head and one tail

we know probability of same outcome from data of $2 = \frac{2}{8}$

Required probability $P(E) = 1 - \frac{2}{8}$

$S = \{TTT, TTH, THH, TH, T, HHH, HHT, HTT, HTH\}$ $= 6/8$ $= 3/4$

* Rule 1, Rule 3 and Rule 4

If we consider data of Q2 also other than that it is not used.

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4. $P(A) = 0.5$ Event A and B are
$P(B) = 0.6$ disjoint

* From Rule 3, we know

$$P(A \cup B) = P(A) + P(B)$$

* from Rule 1, we know

$$0 \leq P(E) \leq 1$$

Rule 1 gets contrary here so it is not possible to have $P(A) = 0.5$ and $P(B) = 0.6$ at same time.

A).

Assignment

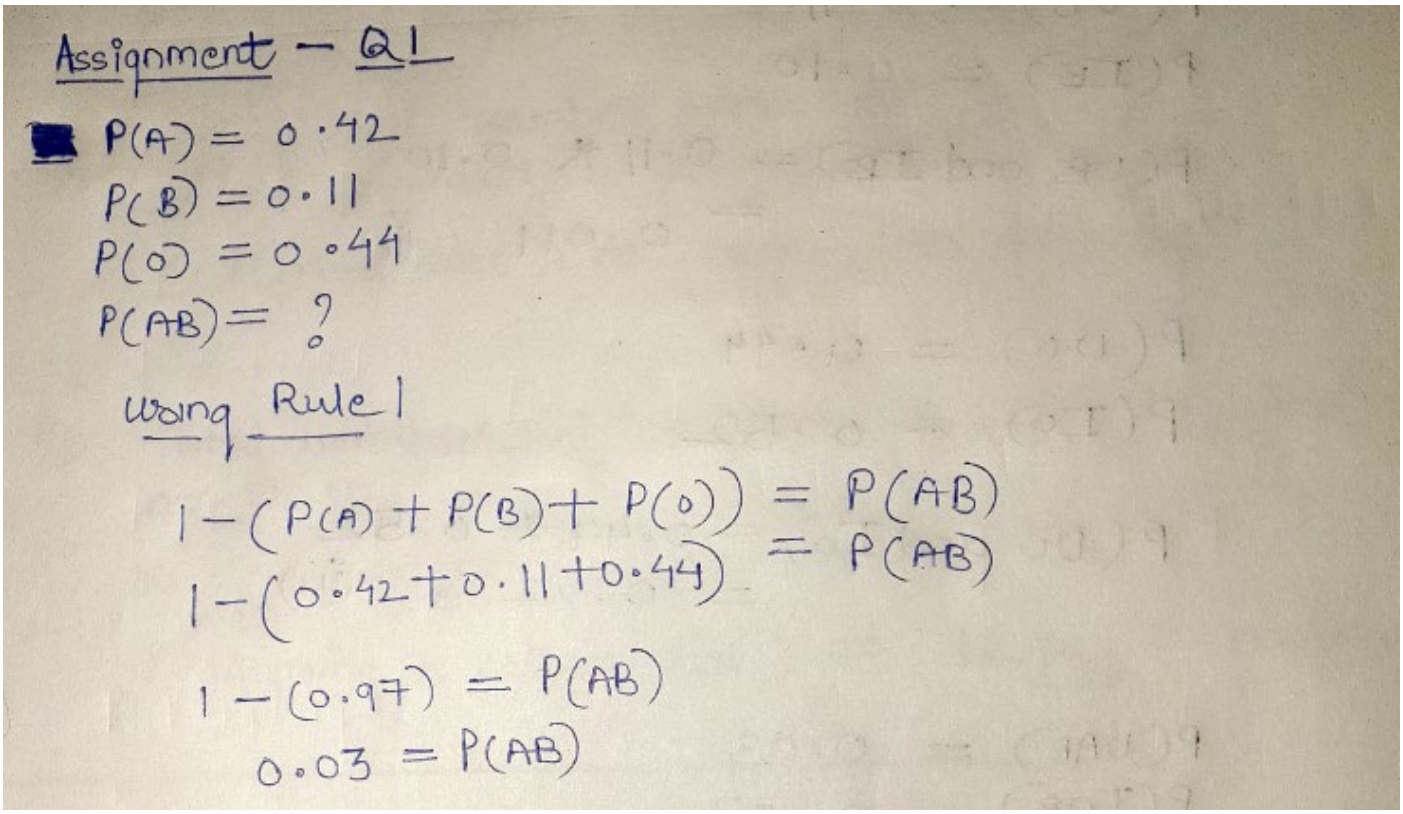
All human blood can be "ABO-typed" as one of O, A, B, or AB, but the distribution of the types varies a bit among groups of people. Here is the distribution of blood types for a randomly chosen person in the United States

Blood type	A	B	AB	O
U.S. probability	0.42	0.11	?	0.44

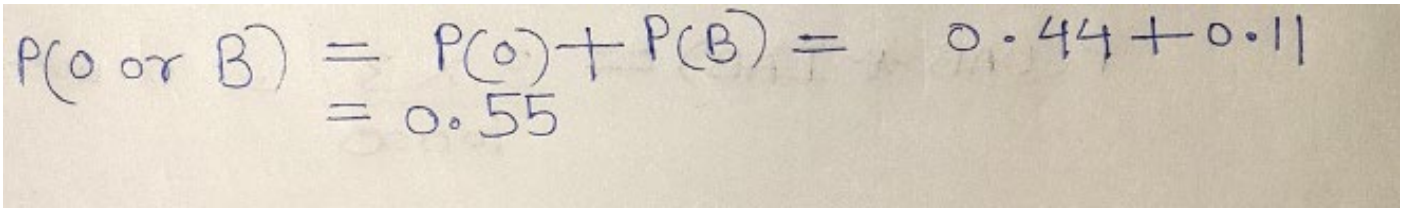
1. What is the probability of type AB blood in the United States?
2. Maria has type B blood. She can safely receive blood transfusions from people with blood types O and B. What is the probability that a randomly chosen person from the United States can donate blood to Maria?
3. Given the probability of Ireland also, choose a person from the United States and a person from Ireland at random, independently of each other. What is the probability that both have type O blood? What is the probability that both have the same blood type?

Blood type	A	B	AB	O
Ireland probability	0.35	0.10	0.03	0.52

1.)



2.)



3.)

$P(IO) = 0.52 \rightarrow$ Probability of Blood Type O Ireland
$P(UO) = 0.44 \rightarrow$ " USA } Independent

Using Rule 5

$P(BO) = P(IO) * P(UO)$
$= 0.52 * 0.44 = 0.2288$

(b) P(Both random of same blood type)-

$P(UA) = 0.42$
$P(IA) = 0.35$ } Both independent event

$P(UA \text{ and } IA) = 0.42 * 0.35$
$= 0.147$ -i)

Similarly with all other blood groups

$P(UB) = 0.11$
$P(IB) = 0.10$

$P(UB \text{ and } IB) = 0.11 * 0.10$
$= 0.011$ -(ii)

$P(UO) = 0.44$
$P(IO) = 0.52$

$P(UO \text{ and } IO) = 0.44 * 0.52$
$= 0.2288$ -(iii)

$P(UAB) = 0.03$
$P(IAB) = 0.03$

$P(UAB * IAB) = \frac{3 \times 3}{10000} = 0.0009$ -(iv)

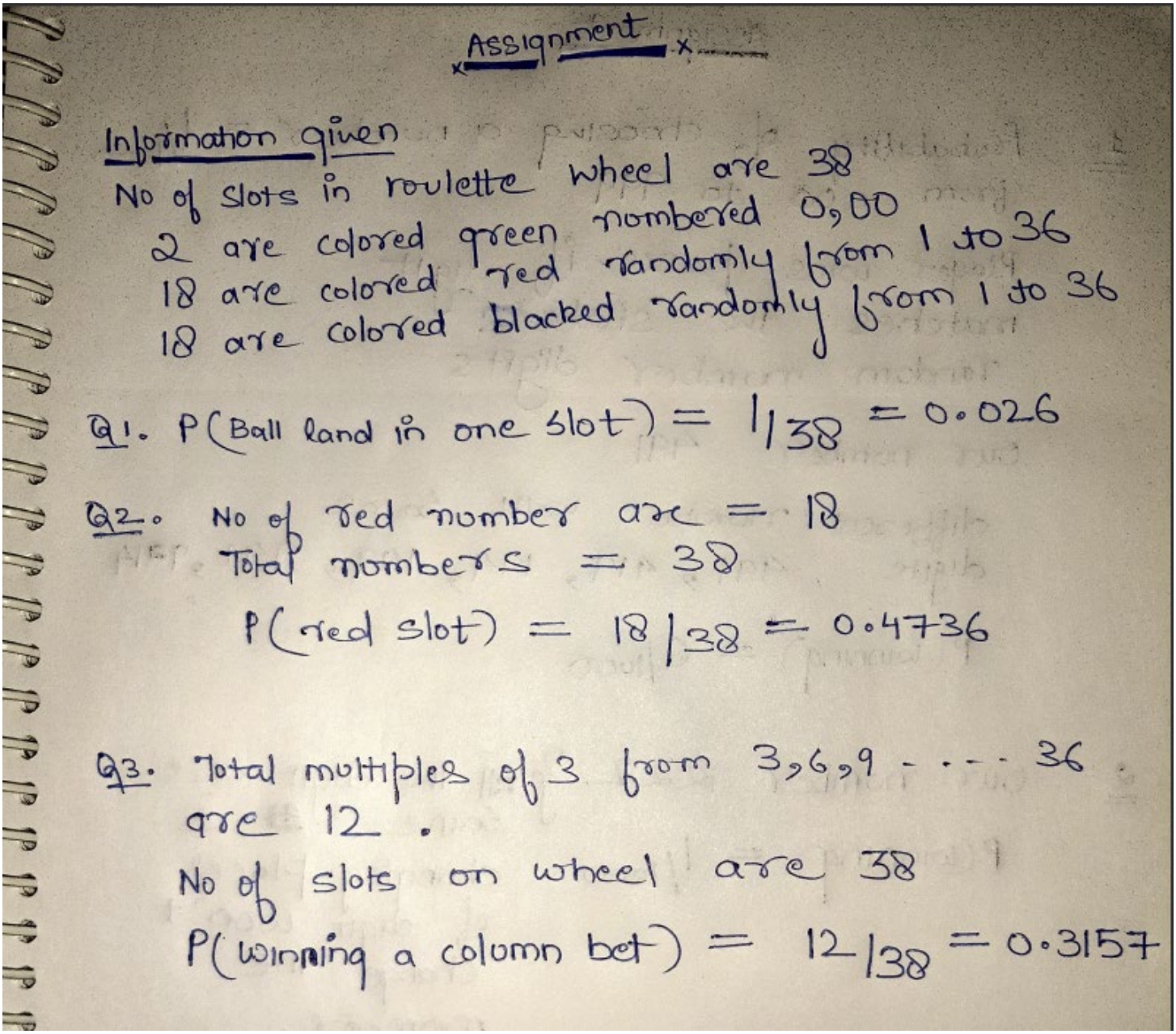
Probability that both have same blood type

$P(E) = 0.147 + 0.011 + 0.2288 + 0.0009$
$= 0.3877$

Assignment

A roulette wheel has 38 slots, numbered 0, 00, and 1 to 36.
The slots 0 and 00 are colored green, 18 of the others are red,
and 18 are black. The dealer spins the wheel and at the same time rolls a small ball along the wheel in the opposite direction. The wheel is carefully balanced so that the ball is equally likely to land in any slot when the wheel slows. Gamblers can bet on various combinations of numbers and colors.

1. What is the probability that the ball will land in any one slot?
2. If you bet on "red," you win if the ball lands in a red slot. What is the probability of winning?
3. The slot numbers are laid out on a board on which gamblers place their bets. One column of numbers on the board contains all multiples of 3, that is, 3, 6, 9, . . . , 36. You place a "column bet" that wins if any of these numbers comes up.
What is your probability of winning?



Assignment

Information given

No of slots in roulette wheel are 38
2 are colored green nombered 0, 00
18 are colored red randomly from 1 to 36
18 are colored blacked randomly from 1 to 36

Q1. P(Ball land in one slot) = 1/38 = 0.026

Q2. No of red number are = 18
Total nombers = 38
P(red slot) = 18/38 = 0.4736

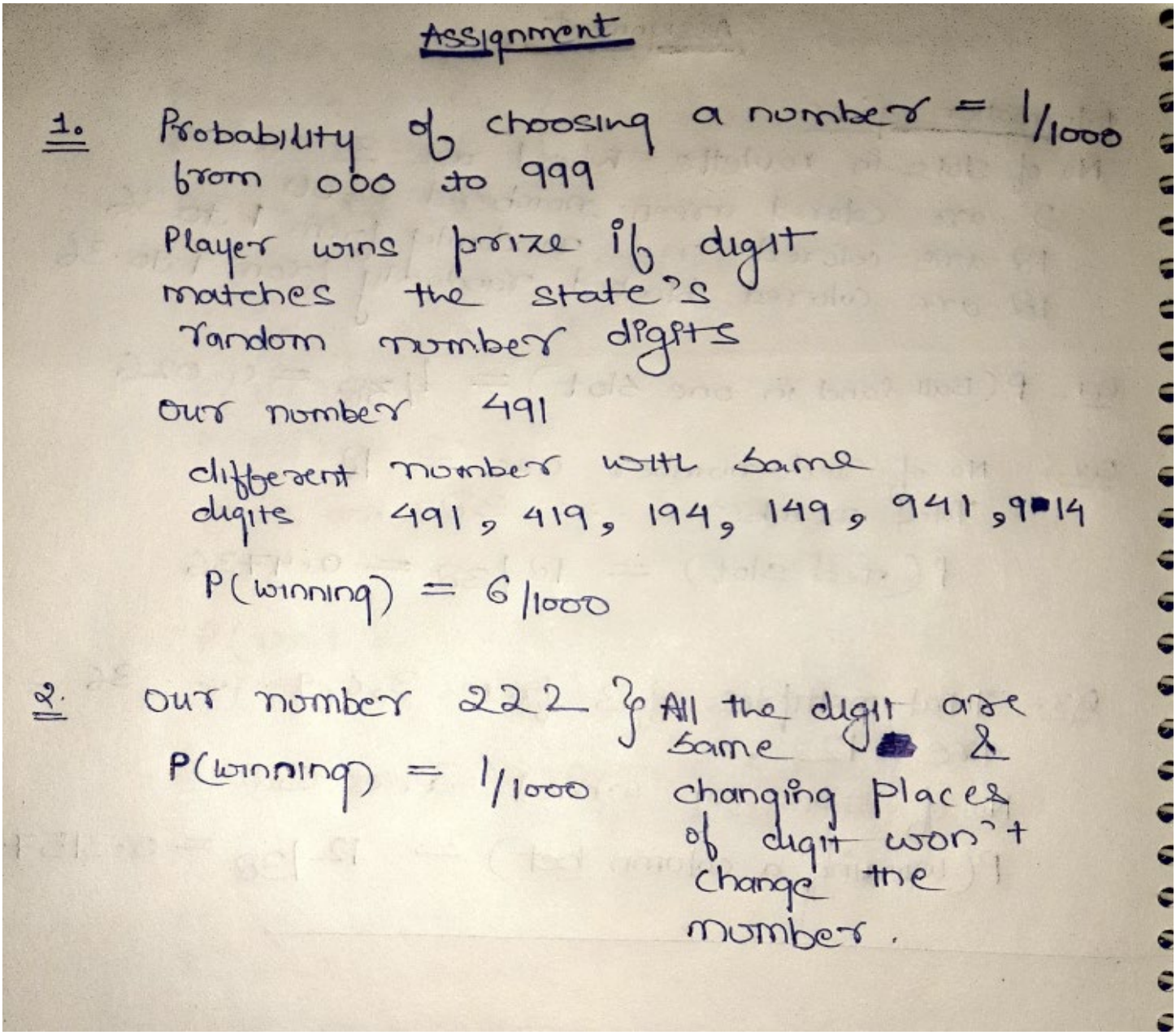
Q3. Total multiples of 3 from 3, 6, 9 - - - - 36 are 12.
No of slots on wheel are 38
P(winning a column bet) = 12/38 = 0.3157

C.)

Assignment

A state lottery's game asks players to choose a three-digit number, 000 to 999. The state chooses the winning three-digit number at random, so that each number has the same probability. You win if the winning number contains the digits in your number, in any order.

1. Your number is 491. What is your probability of winning?
2. Your number is 222. What is your probability of winning?
3. Among 2 friends and yourself, you choose 3 three-digit numbers (your choice) and make a pact that if you win, the ones who lose will get 25% each from the winner. What is the probability that you win anything? What is the probability that you win 25%?



3. Let the numbers be 451, 111, 331

probability of winning of number ① → $\frac{6}{1000}$ $\left(\frac{^3P_3}{1000}\right)$

number ② → $\frac{1}{1000}$

number ③ → $\frac{3}{1000}$ $\left(\frac{^3P_2}{1000}\right)$

I Probability of me or my friends anything is $= \frac{6}{1000} + \frac{1}{1000} + \frac{3}{1000} = 10/1000$

II probability of winning 25%.

Probability My friends win if they have no. 111, 331

$= \frac{1+3}{1000} = 4/1000$

If my friend have no. 451, 111

$= \frac{6+1}{1000} = 7/1000$

If my friend have no. 451, 331

$= \frac{6+3}{1000} = 9/1000$

THANK YOU