**SYNOPSIS REPORT**

**On**

**APPLICATION BASED ON PROBABILITY PREDICTION USING RANDOMIZATION ALGORITHM**

**(MONTE CARLO, LAS VEGAS)**

Created by

KUNAL SHARMA

**Under the guidance of**

Dr. Kingshuk Srivastava

**PROJECT TITLE:** Application based on probability prediction using randomization algorithm

**ABSTRACT**

We are going to calculate the winning probabilities of “player” ,“banker” and “tie” in the game of Baccarat (which is explained further), with the use of Monte Carlo and Las Vegas Algorithms.

**INTRODUCTION**

**Monte Carlo Algorithm:**

Monte Carlo methods, or MC for short, are a class of techniques for randomly sampling a probability distribution.

There are three main reasons to use Monte Carlo methods to randomly sample a probability distribution; they are:

* Estimate density, gather samples to approximate the distribution of a target function.
* Approximate a quantity, such as the mean or variance of a distribution.
* Optimize a function, locate a sample that maximizes or minimizes the target function.

Monte Carlo methods are named for the casino in Monaco and were first developed to solve problems in particle physics at around the time of the development of the first computers and the Manhattan project for developing the first atomic bomb.

Often, we cannot calculate a desired quantity in probability, but we can define the probability distributions for the random variables directly or indirectly.

Monte Carlo methods are a class of techniques for randomly sampling a probability distribution. There are many problem domains where describing or estimating the probability distribution is relatively straightforward, but calculating a desired quantity is intractable. This may be due to many reasons, such as the stochastic nature of the domain or an exponential number of random variables.

Instead, a desired quantity can be approximated by using random sampling, referred to as Monte Carlo methods. These methods were initially used around the time that the first computers were created and remain pervasive through all fields of science and engineering, including artificial intelligence and machine learning.

**Las Vegas Algorithm:**

Las Vegas algorithm is a randomized algorithm that always gives correct results; that is, it always produces the correct result or it informs about the failure. It is a subset of Monte Carlo Algorithm. However, the runtime of a Las Vegas algorithm differs depending on the input. The usual definition of a Las Vegas algorithm includes the restriction that the expected runtime be finite, where the expectation is carried out over the space of random information, or entropy, used in the algorithm. An alternative definition requires that a Las Vegas algorithm always terminates (is effective), but may output a symbol not part of the solution space to indicate failure in finding a solution. The nature of Las Vegas algorithms makes them suitable in situations where the number of possible solutions is limited, and where verifying the correctness of a candidate solution is relatively easy while finding a solution is complex.

Las Vegas algorithms are prominent in the field of artificial intelligence, and in other areas of computer science and operations research. In AI, stochastic local search (SLS) algorithms are considered to be of Las Vegas type. Recently, SLS algorithms have been used to address NP-complete decision problems and NP-hard combinatorial optimization problems. However, some systematic search methods, such as modern variants of the Davis–Putnam algorithm for propositional satisfiability (SAT), also utilize non-deterministic decisions, and can thus also be considered Las Vegas algorithms

**PROBLEM STATEMENT**

Baccarat is a game of cards which contains 8 decks. There are 416*415*414\*413 possible cases in first hand which makes it almost impossible to be followed for patterns/predictions. To be able to even calculate the probabilities with a great deal of accuracy, it takes a large amount of time. Hence, it served as a suitable problem statement that could be solved by our algorithms

**OBJECTIVES**

An Application based on Probability Prediction using Randomization Algorithms. Where winning probability of player, banker and tie is calculated simultaneously with the simulation of game Baccarat.

**METHODOLOGY**

**Baccarat:**

Baccarat or baccara is a card game played at casinos. It is a comparing card game played between two hands, the "player" and the "banker". Each baccarat coup (round of play) has three possible outcomes: "player" (player has the higher score), "banker", and "tie. There are 416415414\*413 possible cases in first hand which makes it almost impossible to be followed for patterns/predictions. To be able to calculate the winning probabilities, we are using the following algorithms:-

1. **Monte Carlo Algorithm:**

Monte Carlo is that class of algorithm which may return the correct result or the incorrect result with some probability. The algorithm resources used in this are often bounded and thus it has a deterministic or fixed run time. It gives better probability results when it is run for a larger number of iterations.

1. **Las Vegas Algorithm:**

A Las Vegas algorithm returns the correct or optimum result always, and informs when it fails. Its run time differs at each run since it depends on a random value, even for the same input.

**SYSTEM REQUIREMENTS**

Software requirement: Dev C++

**REFERENCES**

Refer <https://en.wikipedia.org/> for more details.