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VOLUME 1

INVESTIGATIONS ON PURE MATHEMATICS, FINANCE MATHEMATICS AND OPTICS

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$$\varphi_1(x, y, z) = z$$

$$\pi_1 = \begin{pmatrix} x & y & z \\ y & z & x \end{pmatrix}$$

$$z' = x^2 + y^2 + z^2 + 2yz$$

$$\pi_1 \vee_1 \pi_1 = \vee_{17}$$



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Investigations on Pure Mathematics, Finance Mathematics and Optics

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MARKOV CHAINS AND ITS APPLICATION: THE INVENTORY MODEL

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Prof. Dr. Nasir Ganikhodjaev

Abstract. *This project paper examines the application of Markov chains in real life, thus the inventory model is selected. This model is constructed based on the information obtained from Carrefour East Coast Mall, Kuantan throughout the period of 90 days for only one item. Then, this model is further examined by defining the transition probability matrix based on the demand of the item chosen. Some simulation using Maple 12 is done to determine the regular Markov chains for the demand throughout 90 days. Finally, the obtained limiting probability distribution resulted from the simulation will be used to investigate the behavior of demand for the item selected.*

1 Introduction

Most of the classical study of probability has dealt with independent trial process, which is the basis of classic theory of probability. This process is a study of stochastic that the possible outcomes for each experiment are the same and occur with the same probability. In other words, the classical probability assumes that all outcomes in the experiment are equally likely to occur. It may be explained here that the outcomes of the previous experiment does not influence the outcomes of the next experiment. So, the distribution for the outcomes of a single experiment is sufficient to construct a tree diagram, and a tree measure for a sequence n experiment can give answer for any probability question about these experiments.

Nowadays, study of chance processes for which the knowledge of previous outcomes influence predictions for future experiments are being conducted in modern probability theory. In principle, when we observe a sequence of chance experiments, all of the past outcomes could influence our predictions for the next experiment. This type of process is called a Markov Chain.

1.1 Specifying the Markov Chains

Definition 1.1: A Markov process $\{X_t\}$ is a stochastic process with the property that, given the value of X_t , the value for X_s for $s > t$ are not influenced by the values of X_u for $u < t$. In simpler words, the probability of any particular future behavior of the process, when its current state is known exactly, is not altered by additional knowledge concerning its past behavior.

A discrete-time Markov chain is a Markov process whose state space is a finite or countable set, and whose time index set is $T = (0, 1, 2, \dots)$. In formal terms, the Markov property is that

$$\Pr \{X_{n+1}=j | X_0 = i_0, \dots, X_{n-1} = i_{n-1}, X_n = i\} = \Pr \{X_{n+1}=j | X_n = i\}$$

for all time points n and all states $i_0, \dots, i_{n-1}, i, j$

Let S be the state space of the Markov chain by the nonnegative integers $\{0, 1, 2, \dots\}$, and it is customary to speak X_n as being in state i if $X_n = i$.

The probabilities $P_{ij}^{n,n+1}$ are called one-step transition probability i.e. the probability of X_{n+1} being in state j given that X_n in state i is called the one-step transition probability as followed,