CHAPTER I

INTRODUCTION

Let $\{X_n\}$ be a sequence of random variables each of which takes only the values 0 or 1 ;

$$S_n = X_1 + X_2 + \cdots + X_n ,$$

and

$$b_{i_1 \ldots i_r} = P(X_{i_1} = \cdots = X_{i_r} = 1) ,$$

where $i_1, \ldots, i_r$ are distinct indices $1 \leq i_k \leq n$ and $r = 1, \ldots, n$.

In [7] , B.A. Sevast'yanov proves that if the probabilities $b_{i_1 \ldots i_r}$ satisfy the conditions

(1) $\lim\limits_{n \to \infty} \max\limits_{1 \leq i \leq n} b_i = 0$,

(2) $\lim\limits_{n \to \infty} \sum\limits_{i=1}^{n} b_i = \lambda > 0$,

(3) for each $r = 2, 3, \ldots$ and $n = 1, 2, \ldots$ there exists a set $I_r(n)$ of r-tuples $(i_1, \ldots, i_r)$ of distinct indices satisfying $1 \leq i_k \leq n$ such that

$$\lim_{n \to \infty} \sum_{(i_1, \ldots, i_r) \in I_r(n)} b_{i_1, \ldots, i_r} = 0 ,$$

$$\lim_{n \to \infty} \sum_{(i_1, \ldots, i_r) \in I_r(n)} b_{i_1} \cdots b_{i_r} = 0 ,$$

and

$$\lim_{n \to \infty} \frac{b_{i_1 \cdots i_r}}{b_{i_1} \cdots b_{i_r}} = 1$$

uniformly on $(i_1, \ldots, i_r) \notin I_r(n)$, then

$$\lim_{n \to \infty} P(S_n = k) = \frac{e^{-\lambda} \lambda^k}{k!} , \quad k=0,1,\ldots .$$

In this thesis we extend this result to the case of random vectors. Our main theorem (Theorem 3.2.1) gives a sufficient condition under which the distribution of sums of 2-dimensional random vectors converges to a bivariate Poisson distribution. The possibility of extending our result to the case of higher dimension is also discussed briefly.