Practical-5

AIM: Implement a program to perform Geometric and Poisson Distribution.

THEORY:

1. GEOMETRIC DISTRIBUTION

The geometric distribution represents the number of failures before you get a success in a series of Bernoulli trials. This discrete probability distribution is represented by the probability density function:

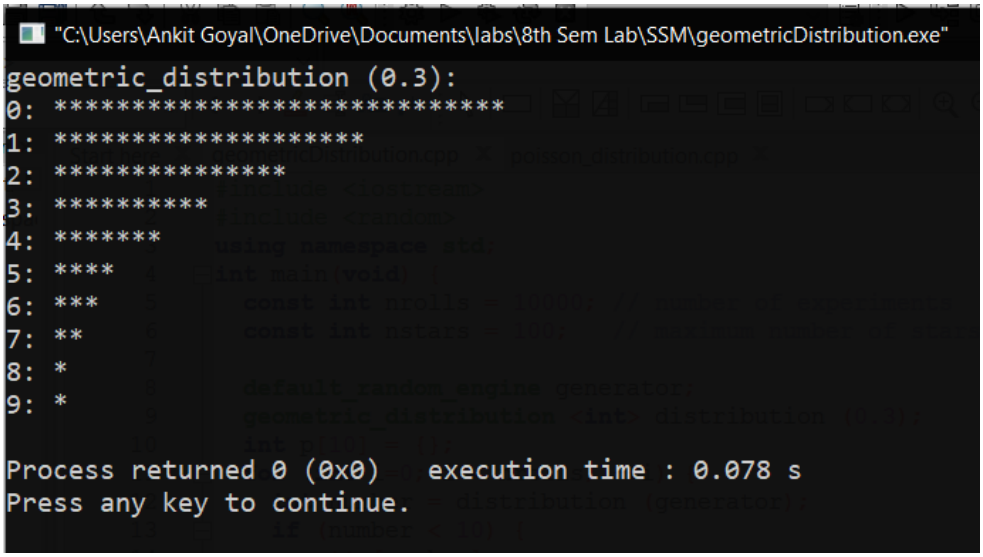
$$f(x) = (1 - p)x - 1p$$

For example, you ask people outside a polling station who they voted for until you find someone that voted for the independent candidate in a local election. The geometric distribution would represent the number of people who you had to poll before you found someone who voted independent. You would need to get a certain number of failures before you got your first success.

Program:

```
#include <iostream>
#include <random>
using namespace std;
int main(void) {
  const int nrolls = 10000; // number of experiments
  const int nstars = 100;   // maximum number of stars to distribute

  default_random_engine generator;
  geometric_distribution <int> distribution (0.3);
  int p[10] = {};
  for (int i=0; i < nrolls; ++i) {
    int number = distribution (generator);
    if (number < 10) {
                ++p[number];
        }
  }
  cout << "geometric_distribution (0.3):" << endl;
  for (int i = 0; i < 10; ++i)
    cout << i << ": " << string(p[i] * nstars / nrolls, '*') << endl;
  return 0;
}
```

Output:


"C:\Users\Ankit Goyal\OneDrive\Documents\labs\8th Sem Lab\SSM\geometricDistribution.exe"
geometric_distribution (0.3):
0: ****************************
1: ********************
2: **************
3: **********
4: *******
5: ****
6: ***
7: **
8: *
9: *
Process returned 0 (0x0) execution time : 0.078 s
Press any key to continue.

2. POISSON DISTRIBUTION

A Poisson distribution is a tool that helps to predict the probability of certain events from happening when you know how often the event has occurred. It gives us the probability of a given number of events happening in a fixed interval of time.

The Poisson Distribution pmf is:

$$P(x; \mu) = (e^{-\mu} * \mu x) / x!$$

Where:

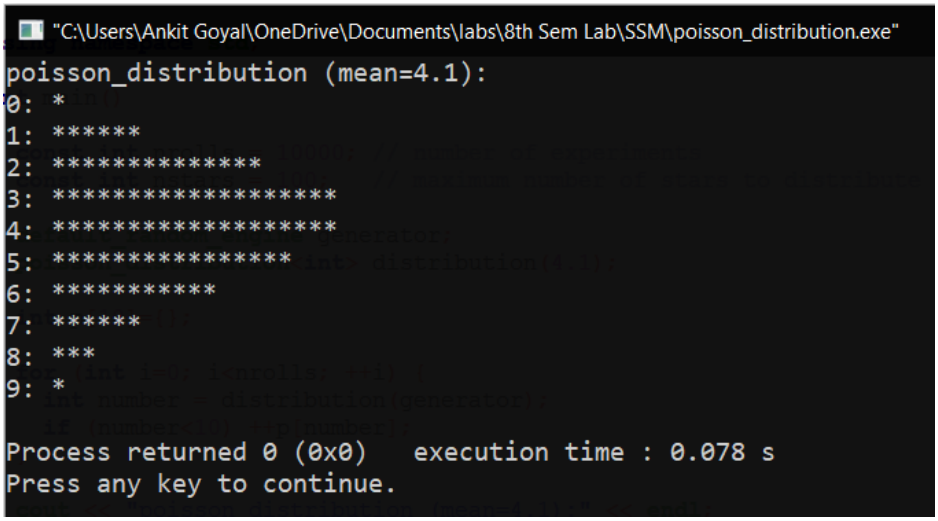
- The symbol "!" is a factorial.
- μ (the expected number of occurrences) is sometimes written as λ.

Sometimes called the **event rate** or rate parameter.

Program:

```
#include <iostream>
#include <random>

using namespace std;

int main()
{
  const int nrolls = 10000; // number of experiments
  const int nstars = 100;   // maximum number of stars to distribute

  default_random_engine generator;
  poisson_distribution<int> distribution(4.1);

  int p[10]={};

  for (int i=0; i<nrolls; ++i) {
    int number = distribution(generator);
    if (number<10) ++p[number];
  }

  cout << "poisson_distribution (mean=4.1):" << endl;
  for (int i=0; i<10; ++i)
    cout << i << ": " << string(p[i]*nstars/nrolls,'*') << endl;

  return 0;
}
```

Output:


"C:\Users\Ankit Goyal\OneDrive\Documents\labs\8th Sem Lab\SSM\poisson_distribution.exe"
poisson_distribution (mean=4.1):
0: *
1: ******
2: **************
3: ******************
4: ******************
5: ***************
6: **********
7: ******
8: ***
9: *
Process returned 0 (0x0) execution time : 0.078 s
Press any key to continue.