PRACTICAL NUMBER 8

**Fitting of binomial distribution and graphical representation of probabilities.**

**Question 1:** Suppose a coin is tossed fifty times and getting a head is a success

1. Represent the probability graphically if the coin is fair.
2. What will happen if the coin is biased and there are 75% chances that it will land head?

Answer :

1. If the coin is fair then,

|  |  |
| --- | --- |
| X | P(FAIR COIN) |
| 0 | 8.88178E-16 |
| 1 | 4.44089E-14 |
| 2 | 1.08802E-12 |
| 3 | 1.74083E-11 |
| 4 | 2.04547E-10 |
| 5 | 1.88184E-09 |
| 6 | 1.41138E-08 |
| 7 | 8.87152E-08 |
| 8 | 4.76844E-07 |
| 9 | 2.22527E-06 |
| 10 | 9.12362E-06 |
| 11 | 3.31768E-05 |
| 12 | 0.000107825 |
| 13 | 0.000315179 |
| 14 | 0.000832974 |
| 15 | 0.001999138 |
| 16 | 0.004373115 |
| 17 | 0.00874623 |
| 18 | 0.016034755 |
| 19 | 0.027005903 |
| 20 | 0.041859149 |
| 21 | 0.059798785 |
| 22 | 0.078825671 |
| 23 | 0.095961686 |
| 24 | 0.107956897 |
| 25 | 0.112275173 |

|  |  |
| --- | --- |
| 26 | 0.107956897 |
| 27 | 0.095961686 |
| 28 | 0.078825671 |
| 29 | 0.059798785 |
| 30 | 0.041859149 |
| 31 | 0.027005903 |
| 32 | 0.016034755 |
| 33 | 0.00874623 |
| 34 | 0.004373115 |
| 35 | 0.001999138 |
| 36 | 0.000832974 |
| 37 | 0.000315179 |
| 38 | 0.000107825 |
| 39 | 3.31768E-05 |
| 40 | 9.12362E-06 |
| 41 | 2.22527E-06 |
| 42 | 4.76844E-07 |
| 43 | 8.87152E-08 |
| 44 | 1.41138E-08 |
| 45 | 1.88184E-09 |
| 46 | 2.04547E-10 |
| 47 | 1.74083E-11 |
| 48 | 1.08802E-12 |
| 49 | 4.44089E-14 |
| 50 | 8.88178E-16 |

***The graphical representation for the same is:***

1. For a biased coin

|  |  |
| --- | --- |
| X | P(biased coin) |
| 0 | 7.88861E-31 |
| 1 | 1.18329E-28 |
| 2 | 8.69719E-27 |
| 3 | 4.17465E-25 |
| 4 | 1.47156E-23 |
| 5 | 4.06152E-22 |
| 6 | 9.13842E-21 |
| 7 | 1.72324E-19 |
| 8 | 2.77873E-18 |
| 9 | 3.89022E-17 |
| 10 | 4.78498E-16 |
| 11 | 5.21997E-15 |
| 12 | 5.08947E-14 |
| 13 | 4.46308E-13 |
| 14 | 3.53858E-12 |
| 15 | 2.54778E-11 |
| 16 | 1.67198E-10 |
| 17 | 1.00319E-09 |
| 18 | 5.51754E-09 |
| 19 | 2.78781E-08 |
| 20 | 1.29633E-07 |
| 21 | 5.5557E-07 |
| 22 | 2.19703E-06 |
| 23 | 8.02393E-06 |
| 24 | 2.70808E-05 |
| 25 | 8.44919E-05 |
| 26 | 0.000243727 |
| 27 | 0.000649938 |
| 28 | 0.001601633 |
| 29 | 0.003645096 |
| 30 | 0.007654701 |
| 31 | 0.014815551 |
| 32 | 0.0263902 |
| 33 | 0.043183964 |
| 34 | 0.064775947 |
| 35 | 0.088835584 |
| 36 | 0.11104448 |
| 37 | 0.126050491 |
| 38 | 0.129367609 |
| 39 | 0.119416254 |
| 40 | 0.09851841 |
| 41 | 0.072086641 |
| 42 | 0.046341412 |
| 43 | 0.025864974 |
| 44 | 0.012344647 |
| 45 | 0.004937859 |
| 46 | 0.001610171 |
| 47 | 0.000411108 |
| 48 | 7.70827E-05 |
| 49 | 9.43869E-06 |
| 50 | 5.66322E-07 |

***The graphical representation for the same is:***

**Question 2:** Fit a binomial distribution for the following data:

|  |  |
| --- | --- |
| X | FREQUENCY |
| 0 | 0 |
| 1 | 4 |
| 2 | 13 |
| 3 | 28 |
| 4 | 42 |
| 5 | 20 |
| 6 | 6 |
| 7 | 2 |

|  |  |  |
| --- | --- | --- |
| X | FREQUENCY | XiFi |
| 0 | 0 | 0 |
| 1 | 4 | 4 |
| 2 | 13 | 26 |
| 3 | 28 | 84 |
| 4 | 42 | 168 |
| 5 | 20 | 100 |
| 6 | 6 | 36 |
| 7 | 2 | 14 |
|  | 115 | 432 |

**MEAN**=3.756521739

**P=**0.536645963

***The expected frequency would be:***

|  |  |  |
| --- | --- | --- |
| X | BINOMIAL DISTRIBUTION | EXPECTED FREQUENCY |
| 0 | 0.004585542 | 0.527337311 |
| 1 | 0.037176082 | 4.275249395 |
| 2 | 0.129169442 | 14.85448585 |
| 3 | 0.249335117 | 28.6735384 |
| 4 | 0.288774184 | 33.2090311 |
| 5 | 0.200670961 | 23.07716051 |
| 6 | 0.077470827 | 8.909145087 |
| 7 | 0.012817847 | 1.474052348 |

**Question 3:** Find the variance of the following data and hence determine the value of success probability

|  |  |
| --- | --- |
| X | F |
| 0 | 0 |
| 1 | 4 |
| 2 | 13 |
| 3 | 28 |
| 4 | 42 |
| 5 | 20 |
| 6 | 6 |
| 7 | 2 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | XiFi | Xi-MEAN | (Xi-Mean)^2 | FI(Xi-Mean)^2 |
| 0 | 0 | 0 | -3.75652 | 14.11145754 | 0 |
| 1 | 4 | 4 | -2.75652 | 7.598413536 | 30.39365 |
| 2 | 13 | 26 | -1.75652 | 3.085369536 | 40.1098 |
| 3 | 28 | 84 | -0.75652 | 0.572325536 | 16.02512 |
| 4 | 42 | 168 | 0.243478 | 0.059281536 | 2.489825 |
| 5 | 20 | 100 | 1.243478 | 1.546237536 | 30.92475 |
| 6 | 6 | 36 | 2.243478 | 5.033193536 | 30.19916 |
| 7 | 2 | 14 | 3.243478 | 10.52014954 | 21.0403 |
|  | 115 | 432 |  |  | 171.1826 |

|  |  |
| --- | --- |
| **MEAN=** | 3.756522 |
| **VARIANCE=** | 1.488544 |
| **Q=** | 0.396256 |
| **P=** | 0.603744 |

***The expected frequencies are:***

|  |  |  |
| --- | --- | --- |
| X | binomdist | ef |
| 0 | 0.001534 | 0.176412 |
| 1 | 0.016361 | 1.881498 |
| 2 | 0.074783 | 8.600071 |
| 3 | 0.189902 | 21.83875 |
| 4 | 0.289339 | 33.27398 |
| 5 | 0.264506 | 30.41816 |
| 6 | 0.134336 | 15.44858 |
| 7 | 0.029239 | 3.362541 |

**Question 4**: Fit the binomial distribution by finding the variance and hence find p and q.:

|  |  |
| --- | --- |
| X | F |
| 0 | 5 |
| 1 | 9 |
| 2 | 22 |
| 3 | 29 |
| 4 | 36 |
| 5 | 25 |
| 6 | 10 |
| 7 | 3 |
| 8 | 1 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | Xifi | Xi-mean | Xi-Mean^2 | fi(xi-mean)^2 |
| 0 | 5 | 0 | -3.55714 | 12.65327 | 63.26633 |
| 1 | 9 | 9 | -2.55714 | 6.53898 | 58.85082 |
| 2 | 22 | 44 | -1.55714 | 2.424694 | 53.34328 |
| 3 | 29 | 87 | -0.55714 | 0.310408 | 9.001841 |
| 4 | 36 | 144 | 0.442857 | 0.196122 | 7.060404 |
| 5 | 25 | 125 | 1.442857 | 2.081836 | 52.04591 |
| 6 | 10 | 60 | 2.442857 | 5.96755 | 59.6755 |
| 7 | 3 | 21 | 3.442857 | 11.85326 | 35.55979 |
| 8 | 1 | 8 | 4.442857 | 19.73898 | 19.73898 |
|  | 140 | 498 |  |  | 358.5429 |

|  |  |
| --- | --- |
| **MEAN=** | 3.557143 |
| **VARIANCE=** | 2.56102 |
| **Q=** | 0.719966 |
| **P=** | 0.280034 |

|  |  |  |
| --- | --- | --- |
| x | binomdist | n\*binomdist |
| 0 | 0.072193 | 10.10704 |
| 1 | 0.224639 | 31.44942 |
| 2 | 0.30581 | 42.81338 |
| 3 | 0.237892 | 33.30491 |
| 4 | 0.115662 | 16.19262 |
| 5 | 0.03599 | 5.038553 |
| 6 | 0.006999 | 0.979884 |
| 7 | 0.000778 | 0.108894 |
| 8 | 3.78E-05 | 0.005294 |