UNIVERSITY OF DELHI

ATMA RAM SANATAN DHARMA COLLEGE

(Dicipline Specific Core)

Probability For Computing

PRACTICAL FILE

Submitted To:

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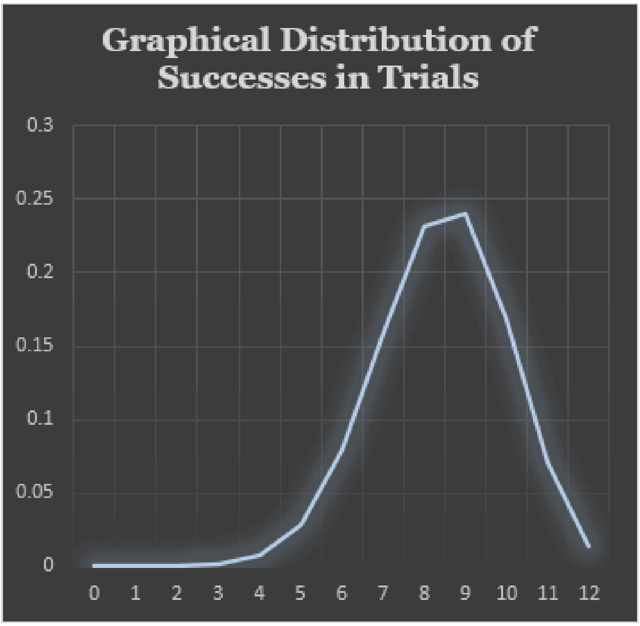
Practical 01

Plotting and fitting of Binomial distribution and graphical representation of probabilities.

C3 =BINOM.DIST(B3, G17, A3, FALSE)

Success Likelihood	Observed Success Count	Probability Mass Value
0.7	0	5.31441E-07
0.7	1	1.48803E-05
0.7	2	0.000190964
0.7	3	0.001485279
0.7	4	0.007797716
0.7	5	0.029111472
0.7	6	0.079247896
0.7	7	0.158495792
0.7	8	0.231139696
0.7	9	0.239700426
0.7	10	0.167790298
0.7	11	0.071183763
0.7	12	0.013841287



Trials	12

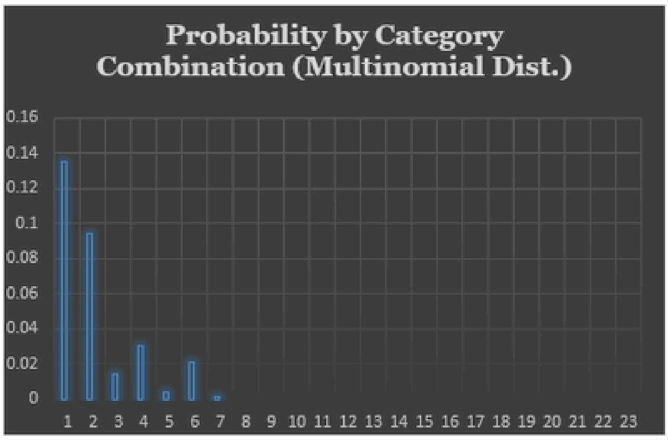
Observation: With p = 0.7 and 12 trials, the distribution is skewed left, peaking near 8 successes.

Practical 02

Plotting and fitting of Multinomial distribution and graphical representation of probabilities.

G3 `=MULTINOMIAL(A3, B3, C3) * ($D$3 ^ A3) * ($E$3 ^ B3) * ($F$3 ^ C3)`

A	B	C	P(A)	P(B)	P(C)	Multinomial distribution	Combination Label
0	2	1	0.2	0.3	0.5	0.135	A=0, B=2, C=1
1	3	4	0.2	0.3	0.5	0.0945	A=1, B=3, C=4
3	0	5	0.2	0.3	0.5	0.014	A=3, B=0, C=5
2	5	3	0.2	0.3	0.5	0.030618	A=2, B=5, C=3
4	4	1	0.2	0.3	0.5	0.0040824	A=4, B=4, C=1
5	6	6	0.2	0.3	0.5	0.02084106	A=5, B=6, C=6
6	1	2	0.2	0.3	0.5	0.0012096	A=6, B=1, C=2



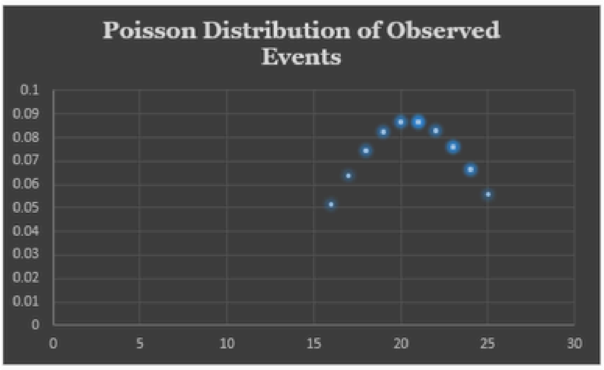
Observation: The probability of each outcome is highest when the category with the largest assigned probability (P(C) = 0.5) has the highest count.
This highlights how the multinomial distribution favors combinations aligned with the underlying probability weights.

Practical 03

Plotting and fitting of Poisson distribution and graphical representation of probabilities.

B3 `=POISSON.DIST(A3,$G$24,FALSE)`

Event Count	Poisson Probability
21	0.086708012
18	0.074271417
21	0.086708012
17	0.063535153
20	0.086536313
16	0.051331371
22	0.082930959
23	0.075869808
21	0.086708012
18	0.074271417
23	0.075869808
21	0.086708012
19	0.082252337
24	0.0665178
25	0.055985815
23	0.075869808
21	0.086708012
20	0.086536313
22	0.082930959
19	0.082252337
24	0.0665178
24	0.0665178
20	0.086536313
23	0.075869808



Mean	21.04

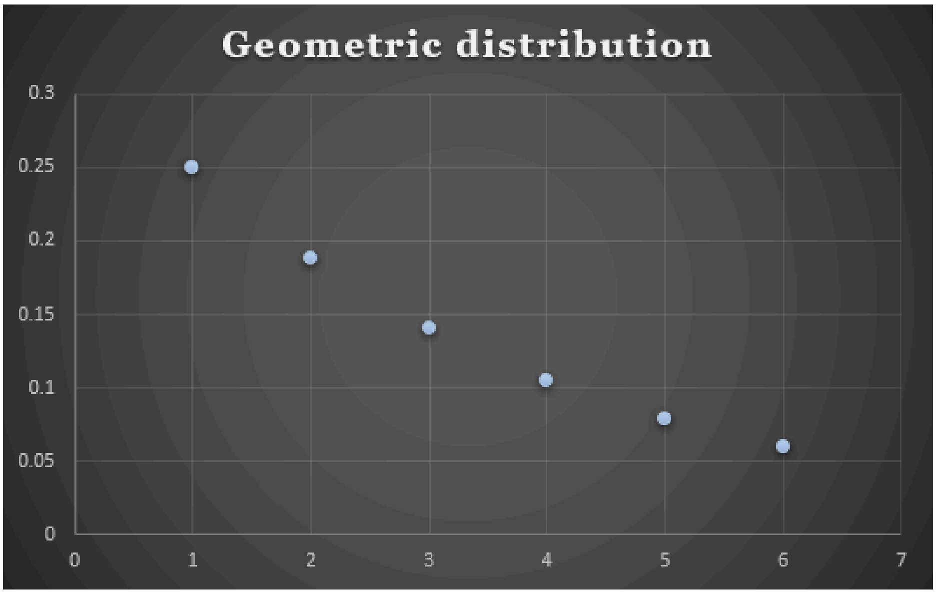
Observation: The probability peaks near the mean (λ ≈ 21), which is characteristic of Poisson distributions. The shape is skewed for lower or higher event frequencies.

Practical 04

Plotting and fitting of Geometric distribution and graphical representation of probabilities.

D3 | f_x =POWER(C3,A3-1)*B3

Attempt Counts	Success Rate	Failure Rate	Probability
1	0.25	0.75	0.25
2	0.25	0.75	0.1875
3	0.25	0.75	0.140625
4	0.25	0.75	0.10546875
5	0.25	0.75	0.079101563
6	0.25	0.75	0.059326172



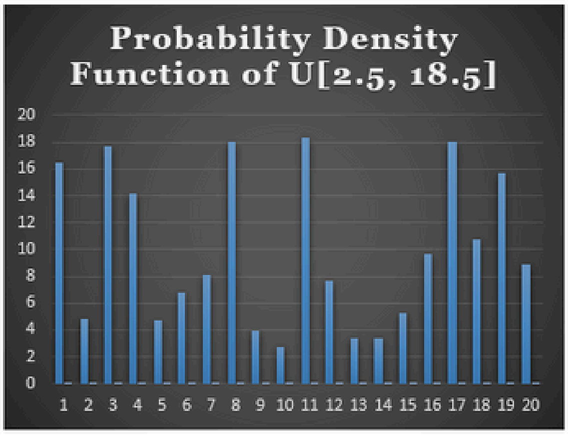
Observation: The probability of success declines exponentially with each trial.
The highest probability is observed on the first trial, consistent with the memoryless nature of geometric distributions.

Practical 05

Plotting and fitting of Uniform distribution and graphical representation of probabilities.

B5 =IF(AND(A5 >= F20, A5 <= F21), 1 / (F21 - F20), 0)

Random Observation (U[a, b])	Equal Probability Density
16.43661363	0.064330674
4.877509986	0.064330674
17.69355851	0.064330674
14.16294224	0.064330674
4.740317863	0.064330674
6.814983557	0.064330674
8.113704223	0.064330674
17.9955817	0.064330674
3.973891723	0.064330674
2.764529181	0.064330674
18.30921312	0.064330674
7.667398264	0.064330674
3.422313149	0.064330674
3.358360926	0.064330674
5.308288	0.064330674
9.694634679	0.064330674
17.99608811	0.064330674
10.72674705	0.064330674
15.70864139	0.064330674
8.867001499	0.064330674



Min	2.765
Max	18.31

Observation: The probability density for a continuous uniform distribution remains constant across the defined interval [a, b].
Each value in this range is equally likely, hence forming a flat distribution.

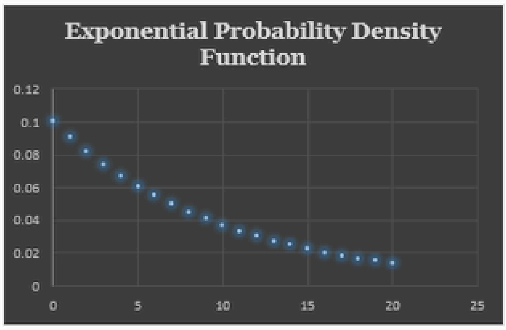
Practical 06

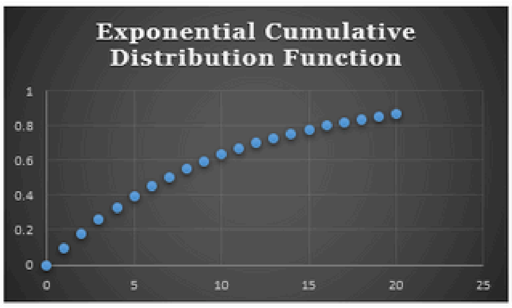
Plotting and fitting of Exponential distribution and graphical representation of probabilities.

C5 =0.1 * EXP(-0.1 * A5)

Observed Intervals (t)	Cumulative Distribution (CDF)	Probability Density (PDF)
0	0	0.1
1	0.095162582	0.090483742
2	0.181269247	0.081873075
3	0.259181779	0.074081822
4	0.329679954	0.067032005
5	0.39346934	0.060653066
6	0.451188364	0.054881164
7	0.503414696	0.04965853
8	0.550671036	0.044932896
9	0.59343034	0.040656966
10	0.632120559	0.036787944
11	0.667128916	0.033287108
12	0.698805788	0.030119421
13	0.727468207	0.027253179
14	0.753403036	0.024659696
15	0.77686984	0.022313016
16	0.798103482	0.020189652
17	0.817316476	0.018268352
18	0.834701112	0.016529889
19	0.850431381	0.014956862
20	0.864664717	0.013533528

Mean of Intervals (μ)	10
Rate parameter (λ = 1/μ)	0.1





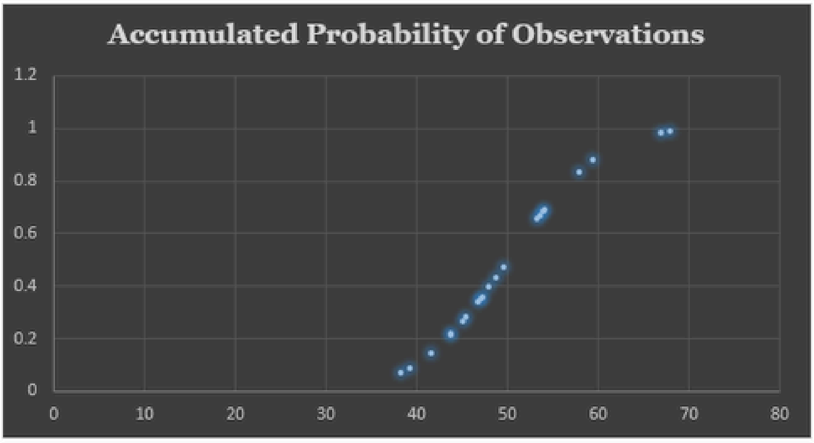
The PDF curve starts at the rate parameter (λ) and decays exponentially, while the CDF steadily rises toward 1
. Both highlight the memoryless nature of exponential processes.

Practical 07

Plotting and fitting of Normal distribution and graphical representation of probabilities.

B3 =NORM.DIST(A3,E21,E22,TRUE)

Sample Observation (x)	Distribution
43.76811326	0.2185308
48.66904148	0.433288263
53.24555035	0.655725203
38.19319841	0.070768236
39.28045134	0.090945652
66.87689654	0.981919798
46.99839838	0.353585006
43.65877481	0.214543537
53.55780955	0.669899658
57.82831697	0.834085069
54.03109998	0.690921229
67.87415498	0.9867591
45.00114163	0.266344449
53.84515633	0.682731807
41.52492297	0.145488704
47.15916138	0.361040985
47.90483172	0.396277103
59.43298146	0.878976357
49.49362727	0.47388099
46.69684141	0.339751553
45.39515852	0.282668408



Mean (μ)	50.02
Standard Deviation (σ)	8.045

Observation: The cumulative probability curve rises slowly in the tails and rapidly around the mean (μ ≈ 50), indicating most values are centered. This S-shaped curve reflects the characteristics of a standard normal CDF.

Practical 08

Calculation of cumulative distribution functions for Exponential and Normal distribution.

Exponential Model Evaluation	λ =	0.4	
	x =	3	
Comparative Analysis of CDFs	0.698805788		Formula Used: =EXPON.DIST(E4, E3, TRUE)
Standard Normal Assessment	σ =	2	
	μ =	10	
	x =	12	
Evaluated CDF at Given x	0.841344746		Formula Used:=NORM.DIST(E10,E9,E8,TRUE)

Observation: The exponential CDF exhibits a sharp increase early due to its memoryless nature, whereas the normal CDF grows symmetrically around the mean. The evaluated values reflect these distribution characteristics at specific x-points.

Practical 09

Application problems based on the Binomial distribution.

	A	B	C	D	E
1					
2	According to recent tech incubation data, 80% of AI-driven startups experience profitability in their first operational year.				
3	If a batch of 10 such startups is evaluated, what's the probability that exactly 7 succeed in turning a profit?				
4					
5	Given That :				
6					
7	Total Startups in Sample (n)	10			
8	Success Probability per Startup	0.8			
9					
10	P(x = 7): Probability of Exactly 7 Successful Startups		0.201		Formula Used: =BINOM.DIST(7,B7,B8,FALSE)
11					
12	Observation: The highest likelihood scenario, given p = 0.8 over 10 trials, is having 8 successes.				
13	However, the probability of getting exactly 7 still remains significant, supporting the robustness of these AI startup outcomes.				

Practical 10

Application problems based on the Poisson distribution.

	A	B	C	D
1				
2	A tech support center observes, on average, 3 critical system crashes every 20 days.			
3	Estimate the probability that there will be no more than one crash within any randomly chosen day.			
4				
5	Given That :			
6				
7	Mean(λ) = 3 failures / 20 days	0.15		
8	x	1		
9				
10	P(X ≤ 1): Probability of ≤ 1 crash in a day	0.989814173		Formula Used: =POISSON.DIST(1,B7, TRUE)
11				
12	Observation: With a crash rate of 0.15 per day, the system is highly reliable.			
13	The probability of observing no more than one crash on any given day is nearly 99%, consistent with rare-event behavior modeled by the Poisson distribution.			

Practical 11

Application problems based on the Normal distribution.

A university department tracks entrance test scores for graduate admissions.
The scores follow a normal distribution with a mean of 100 and a standard deviation of 15.

What's the probability that a randomly selected applicant scores above 120?
What's the probability that an applicant scores 85 or less on the entrance test?

Given That:

Mean	Standard deviation
100	15

P(x ≥ 120):	0.09121122	Formula Used: =1-NORMDIST(120, C14, D14, TRUE)
P(x ≤ 85):	0.158655254	Formula Used: =NORMDIST(85, C14, D14, TRUE)

Observation: Given the normal distribution of test scores (μ = 100, σ = 15), approximately 9.1% of applicants score above 120, placing them in the top percentile.
Meanwhile, about 15.9% fall below 85, indicating a modest lower tail spread.

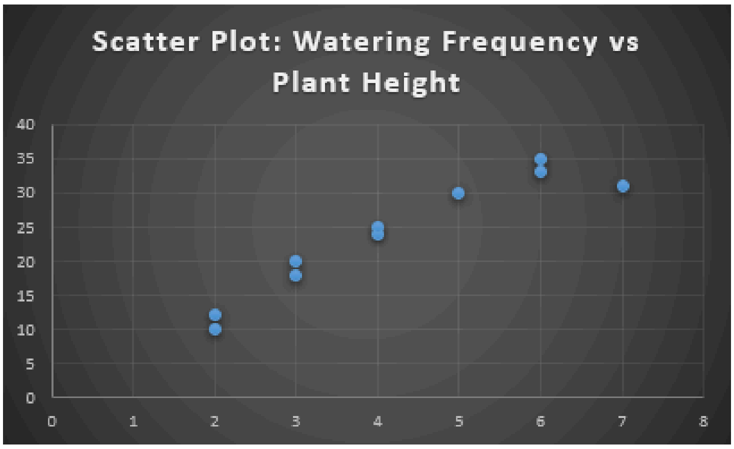
Practical 12

Presentation of bivariate data through scatter-plot diagrams and calculations of covariance.

Watering frequency (X, in times/week) and plant height (Y, in cm) were recorded across 10 test plots to analyze plant response.

X (Watering/week)	Y (Height in cm)
2	12
3	20
4	24
5	30
6	33
7	31
3	18
2	10
4	25
6	35

Covariance	12.94



Observation: A positive covariance suggests that increased watering frequency is associated with taller plant growth.
This linear relationship reflects how environmental factors impact plant development.

Practical 13

Calculation of Karl Pearson's correlation coefficients.

Evaluating the Degree of Linear Relationship Using Karl Pearson's Correlation Coefficient

The following dataset records study hours per week (X) and corresponding test scores (Y) across five students to analyze their correlation.

X (Hours Studied)	Y (Test Scores)
2	55
4	63
6	70
5	68
3	60

Karl Pearson Correleation coefficient	0.9918
Formula Used: =CORREL(C7:C11, D7:D11)	

Observation: A high positive correlation (r ≈ 0.99) indicates a strong linear relationship between study time and test scores.
This supports the assumption that increased preparation is associated with better performance.

Practical 14

To find the correlation coefficient for a bivariate frequency distribution.

Estimating the Linear Correlation in Grouped Observations using Pearson's Coefficient

Average monthly rainfall (X, in mm) and pest infestation rate (Y, as frequency count) were observed across 10 agricultural zones to s

X (Rainfall mm)	Y (Infestation count)
80	5
60	12
95	4
100	3
70	8
85	6
50	15
65	10
90	5
55	13

Pearson's Correlation Coefficient	-0.974

Formula Used: =CORREL(B6:B15,C6:C15)

Observation: The negative correlation (r ≈ -0.97) indicates that as rainfall increases, pest infestation tends to decrease.
This suggests a possible suppressive environmental effect on pest development.

Practical 15

Generating Random numbers from discrete (Bernoulli, Binomial, Poisson) distributions.

Random Number Generation from Discrete Distributions

	Trial 1	Trial 2	Trial 3	Formula
Bernoulli Trial Outcome	1	1	1	Formula Used: =IF(RAND() <= 0.6, 1, 0)
Binomial Event Simulation	3	4	6	Formula Used: =BINOM.INV(8, 0.6, RAND())
Poisson Process Counts	0.256515621	0.25652	0.256515621	Formula Used: =POISSON.DIST(2, 2.5, FALSE)

Observation: Bernoulli trials result in binary outcomes based on probability p. Binomial values reflect counts of successes in n trials.
Poisson-distributed outputs simulate rare events occurring in fixed intervals.

Practical 16

Generating Random numbers from continuous (Uniform, Normal) distributions.

Random Number Generation from Continuous Distributions

	Trial 1	Trial 2	Trial 3	Formula
Normal Distribution	35.43088052	54.4588	43.06563803	Formula Used: =NORM.INV(RAND(), 50, 10)
Uniform Distribution	3.727101348	3.55289	3.187260737	Formula Used: =RAND() * (8 - 3) + 3

Observation: The normal distribution generates values symmetrically around a mean (μ = 50), reflecting natural variation.
Uniform distribution spreads values evenly within a defined range [3, 8], with equal probability of occurrence.