Note: Use SPSS to solve the following questions. For every question Write the SPSS commands and then copy and paste the output page here (or in some cases the screen shot of the data view that shows the output).

Question 1: If the probability of finding a defective product of a company's total products is given as 1 out of hundred, with a sample size of 200 chosen, Assuming Poisson distribution, what is the probability that

$p = 0.01$, $n = 200$, $\lambda = np = 2$

Q1X	Q1ProX	Q1CProX
0	.1353	.1353
1	.2707	.4060
2	.2707	.6767
3	.1804	.8571
4	.0902	.9473

```
COMPUTE Q1PropX=PDF.POISSON(Q1X,2).
EXECUTE.
COMPUTE Q1CdfX=CDF.POISSON(Q1X,2).
EXECUTE.
```

(i) At least 2 are defective

Transform → Compute variable →CDF & Noncentral CDF → Cdf.Poisson → CDF.POISSON(quant, mean)

$P(X \geq 2) = 1 - 0.4060 = 0.594$

(ii) At most 3 are defective

Transform → Compute variable →CDF & Noncentral CDF → Cdf.Poisson → CDF.POISSON(quant, mean)

$P(X \leq 3) = 0.8571$

(iii) More than 2 but less than 4 items are defective

Transform → Compute variable → PDF & Noncentral PDF → Pdf.Poisson → PDF.POISSON(quant, mean)

$P(2 < X < 4) = P(3) = 0.1804$

(iv) Exactly 3 are defective.

Transform → Compute variable → PDF & Noncentral PDF → Pdf.Poisson → PDF.POISSON(quant, mean)

$P(X =3) = 0.1804$

Question 2: The probability of producing a perfect drill is .95. If 5 drills are chosen at random, Assuming Binomial distribution, what's the probability that:

Q2X	Q2ProfX	Q2CProX
1	.0000	.0000
2	.0011	.0012
3	.0214	.0226
4	.2036	.2262
5	.7738	1.0000

```
COMPUTE Q2ProfX=PDF.BINOM(Q2X,5,0.95).
EXECUTE.
COMPUTE Q2CProX=CDF.BINOM(Q2X,5,0.95).
EXECUTE.
```

a. exactly 3 are perfect?

Transform → Compute variable → PDF & Noncentral PDF → Pdf.Binom →PDF.BINOM(quant, n, prob)

$P(X = 3) = 0.0214$

b. exactly 4 are perfect?

Transform → Compute variable → PDF & Noncentral PDF → Pdf.Binom →PDF.BINOM(quant, n, prob)

$P(X = 4) = 0.2036$

c. 3 or more are perfect?

Transform → Compute variable →CDF & Noncentral CDF → Cdf.Binom → Cdf.Binom (quant, n, prob)

$P(X \geq 3) = P(3) + P(4) + P(5) = 0.9988$

d. between 2 and 4 are perfect?

Transform → Compute variable → PDF & Noncentral PDF → Pdf.Binom →PDF.BINOM(quant, n, prob)

If exclusive , $P(2 < X < 4) = P(3) = 0.0214$

If inclusive , $P(2 \leq X \leq 4) = P(2) + P(3) + P(4) = 0.2261$

Question 3: Suppose the time it takes a nine-year old to eat a donut is between 0.5 and 4 minutes, inclusive. Let X = the time, in minutes, it takes a nine-year old child to eat a donut. Then X~ U (0.5, 4).

Transform→ Compute variable→ CDF & Noncentral CDF→ Cdf.Uniform→ CDF.UNIFORM(quant, min, max)

Q3X	Q3CProX
0	.0000
1	.1429
2	.4286
3	.7143
4	1.0000

```
COMPUTE Q3CProX=CDF.UNIFORM(Q3X,0.5,4).
EXECUTE.
```

1. The probability that a randomly selected nine-year old child eats a donut in at least two minutes is ___ 0.5714___.

2. The probability that a randomly selected nine-year old child eats a donut in maximum three minutes is ___0.7142____.

3. The probability that a randomly selected nine-year old child eats a donut in between 1 and 3 minutes is ___0.5714____.

Question 4: (In this problem first find the probability by using SPSS and then calculate the number of trees manually by using the probabilities.)

A certain variety of pine tree has a mean trunk diameter of $\mu = 150$ cm, and a standard deviation of $\sigma = 30$ cm which is normally distributed. A certain section of a forest has 500 of these trees. Find Approximately

Transform→Compute variable→ CDF &Noncentral CDF→ Cdf.Normal→ CDFNORMAL(quant, mean, stddev)

Q4X	Q4CProX
110	.0912
120	.1587
130	.2525
140	.3694
150	.5000
160	.6306

```
COMPUTE Q4CProX=CDF.NORMAL(Q4X,150,30).
EXECUTE.
```

1. how many of these trees have a diameter smaller than 120

P(X < 120) = 0.1587 = 15.87% , 0.1587 × 500 ≈ 79 trees

2. how many of these trees have a diameter greater than 160

P(X >160) = 1 - P(160) = 1- 0.6305 = 0.3695 = 36.95% , 0.3695 × 500 ≈ 185 trees

3. how many of these trees have a diameter between 130 and 160.

P(130 < X < 160) = P(160) - P(130) = 0.6305 - 0.2524 = 0.3781 = 37.81% , 0.3781 × 500 ≈ 189 trees

4. how many of these trees have a diameter between 120 and 140.

P(120 < X < 140) = P(140) - P(120) = 0.3694 - 0.1586 = 0.2108 = 21.08% , 0.2108 × 500 ≈ 105 trees

Question 5: A cross-over trial investigated whether eating oat bran changes serum cholesterol levels. Fourteen (14) individuals were randomly assigned a diet that included either oat bran or corn flakes. After two weeks on the initial diet, serum cholesterol were measured and the participants were then "crossed-over" to the alternate diet. After two-weeks on the second diet, cholesterol levels were once again recorded. Data appear below. The variable CORNFLK in the table represents cholesterol level (mmol/L) of the participant on the corn flake diet. The variable OATBRAN represents the participant's cholesterol on the oat bran diet.

ID	CORNFLK (mmol/L)	OATBRAN (mmol/L)
1	4.61	3.84
2	6.42	5.57
3	5.40	5.85
4	4.54	4.80
5	3.98	3.68
6	3.82	2.96
7	5.01	4.41
8	4.34	3.72
9	3.80	3.49
10	4.56	3.84
11	5.35	5.26
12	3.89	3.73
13	2.25	1.84
14	4.24	4.14

Use t-test to test the a hypothesis that there is no significance difference between the cholesterol levels.

Analyze → Compare Means → paired sample t-test → Select paired variables → OK

$H_0 : \mu_1 = \mu_2$, there is no significance difference

$H_1 : \mu_1 \neq \mu_2$, there is a significance difference

Since p-value = 0.005 , which is less than 0.05 , we reject H_0 and accept H_1, which means that there is a significance difference between the cholesterol levels.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CORNFLK	4.4436	14	.96883	.25893
	OATBRAN	4.0807	14	1.05698	.28249

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	CORNFLK & OATBRAN	14	.923	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference: Lower	Upper			
Pair 1	CORNFLK - OATBRAN	.36286	.40596	.10850	.12846	.59725	3.344	13	.005