**Task 2 –**

**Probability (Discrete):**

a) What is the probability of rolling exactly two 6s in five rolls of a fair die?

b) The number of industrial injuries on average per working week in a factory is 0.75. If the distribution of injuries follows a Poisson distribution, find the probability that in a particular week there will be no more than two accidents.

Stating the answers alone here is not sufficient - you should show clearly how you found your answer, justify any decisions made, and include plots where appropriate.

**Binomial distribution**

F(x)= P(x=x) = (n/x) px q n-x

x = # of times for a specific outcome within n trials

(n/x) = number of combinations

p = probability of success on a single trial

q= probability of failure on a single trial

n= number of trials

p (exactly 2 6’s) p(x=6) = 1/6 p (x≠6) =5/6

n=5 rolls q= 6/6-1/6 = 5/6

n=5 P(x=2) = (5/2)(1/6)2(5/6)3

x=2 10

p=1/6 = 0.16075

q=5/6 (probability of not rolling a 6)

f(x) = p(x=2) = (5/2) (1/6) 2 (5/6)5-2

= (5/2) \*(1/6) 2 \* (5/6)3

=10 \* 0.02777\*0.5787

=0.16075

=0.16

Therefore, the probability of rolling 2 6’s In 5 rolls of a die is 0.16075

**b) Poisson Distribution**

f(x) = P(x=x) = λx/x! e-λ

p(x)= probability of exactly (x) occurrences in each interval

λ= mean # of occurrences during interval

x= # of occurrences desired

e=base of natural logarithm

λ= 0.75

p(x≤2) = p(x=0) + p(x=1) + p(x=2)

= 0.75(0) e-0.75/0! + 0.75(1) e –(0.75) / 1! + 0.75(2) e –(0.75) /2!

Now I sum them up:

=0.47236 + 0.35427 + 0.13285

=0.95949

=0.96

In conclusion the probability that in a particular week there will be no more than 2 accidents in the factory is approximately 0.96

**Task 3 - Probability (Continuous):**

The time a person spends at Dublin Zoo is Normally distributed with a mean of 90 minutes and a standard deviation of 10 minutes.

Using this distribution, answer the following:

a) If a visitor is selected at random, find the probability that they will spend at most 85 minutes visiting the zoo.

b) If a visitor is selected at random, find the probability that they will spend at least 100 minutes visiting the zoo.

c) Given that you know that a particular visitor has spent longer than average visiting the Zoo, what is the probability that they have spent more than 100 minutes there?

Stating the answers alone here is not sufficient - you should show clearly how you found your answer, justify any decisions made, and include plots where appropriate.

**Normal distribution**

f(x)=2πσ2​1​⋅e−2σ2(x−μ)2​  
f(x) = probability density function

σ= standard deviation

μ= mean

μ=90

σ =10 σ2=100

a) At most 85 minutes f(x≤85mins)

f(x≥100mins) = 1-

f(x>100mins) = 1-p(x=100)

I convert to standardized form.

X~N (90,100)

Z= x- μ/ σ ~N (0,1)

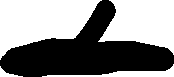
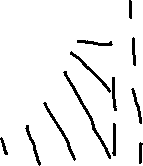
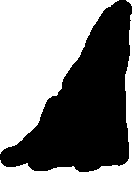
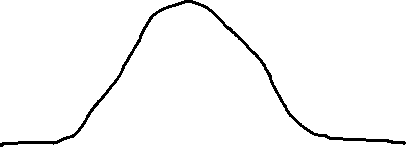
a) P(x≤85)



p(x≤85) = p (Z ≤ z)

First, I calculate the z-score

Looking for the shaded area



85 90

Z=0.5

Z= 85-90/10 = -0.5

Then I find the cumulative probability associated with the z-score

P(x≤85) = p(z≤-0.5) = 0.30854

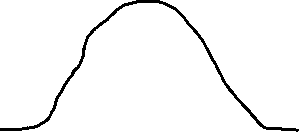
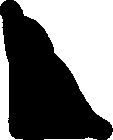
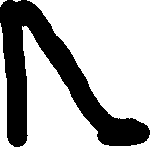
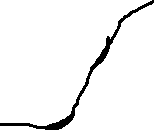
In conclusion, the probability that a randomly selected visitor will spend at most 85 minutes visiting Dublin Zoo is 30.85%

b) P(x≥100) = p (z ≥ z) = 1-p(x<100)

First, I calculate the z-score.



Looking for the shaded area



90 100

Z=1

Z= 100-90/10 = 1

Then I find the complementary cumulative probability associated with the z-score

P(x≥100) = p(z≥1) = 1-p(x<100)

= 1- 0.8413

=0.1587

Therefore, the probability that a randomly selected visitor will spend at least 100 minutes visiting Dublin Zoo is 15.87%

c) p(x>100 | x>90)

I use complementary cumulative distribution.

Calculate p(x>100):

z100 = 100-90/10 = 1

I look up the z-score of 1 in a z-table.

1-0.8413 = 0.1587

Calculate p(x>90):

z90 = 90-90/10 = 0

I look up the z-score of 0 in a z-table.

1-0.5 = 0.5

Since my probabilities are 0.1587 and 0.5, I can now calculate the conditional probability.

p(x>100 | x>90) = p(x>100 )/p(x>90)

=0.1587/0.5

=0.3147

In summary, the probability that a randomly selected visitor will spend more than 100 minutes visiting Dublin Zoo is 31.74%