4
Distributions
(2012 − 2013 Academic Year: Tutorial Questions)

Exercises

4.1 Determine the Binomial probability associated with flipping an unbiased coin five times and obtaining either no heads or all heads.

4.2 Determine the Binomial probability associated with flipping a biased coin with $p = 0.4$ five times and obtaining either no heads or all heads.

4.3 Determine the Binomial probability associated with flipping a biased coin with $p = 0.4$ five times and obtaining three heads and two tails.

4.4 Determine the Poisson probability to observe zero signal events in an experiment given $\lambda = 3$.

4.5 Determine the cumulative Poisson probability to observe at least three signal events in an experiment given $\lambda = 3$.

4.6 Compute the ratio of the likelihood of observing one event with respect to that of observing five events given a Poisson distribution with $\lambda = 4$.

4.7 Determine the probability contained within ± 1, ± 2, and ± 3 σ for a Gaussian distribution.

4.8 What z value has approximately 90% of the probability below, and 10% of the probability above it for a Gaussian distribution?

4.9 What is the likelihood for $z = \pm 1\sigma$ for a Gaussian distribution, assuming $\mathcal{L}_{max} = 1$?

4.10 What is the probability for $\chi^2 = 5$ given four degrees of freedom? Is the result reasonable?

4.11 What is the probability for $\chi^2 = 1$ given ten degrees of freedom? Is the result reasonable?

4.12 What is the probability for $\chi^2 = 8$ given two degrees of freedom? Is the result reasonable?

4.13 Compute the mean and variance of the sum of two Poisson distributions with means of λ_1 and λ_2, respectively. What do you conclude from this?

4.14 Compute the expectation value of some variable x distributed according to a probability density function $P(x) = a + e^{-x}$, over the domain $0 \leq x \leq 1$.

4.15 Compute the variance of x distributed according to the probability density function given in the previous question.