A1 – CS4300

Random Actions in a Wumpus World

# Introduction

The rand function in Matlab is touted to sample the uniform probability distribution. It uses a pseudo-random number generation algorithm, and the issues to be addressed are:

• Is the mean of a set of samples 0.5?

• Is the variance of a set of sample 1/12?

# Method

The method used here is simply to generate a large number of samples and compute the mean, variance and confidence of the result. An alternative would be to run a large number of trials where each trial would get a fixed number of samples from rand, and then compute the mean and variance of each trial, and then compute the mean and variance over all those trials. This latter approach was not implemented.

# Verification of Program

The method was applied to 1 sample and the results are found to be:

• the mean is the one sample

• the variance is 0.

>> a = rand

a = 0.8431

>> mean(a)

ans = 0.8431

>> var(a)

ans = 0

>>

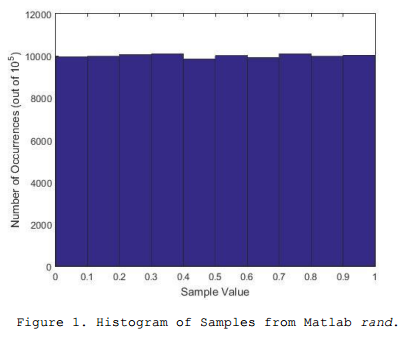
Also, a large number of samples was generated and each was checked to make sure it was in the interval [0,1].

>> find(samps1)

ans = Empty matrix: 0-by-1

# Data

Figure 1 shows the data collected from Matlab rand.



# Analysis

The mean was found to be: 0.5002 The variance was found to be: 0.834 (note that 1/12 = 0.833)

The confidence interval at the 95% level is: [0.4987,0.5017].

# Interpretation

The results produced by rand are very close to the theoretical values of the mean and variance and the confidence interval at the 95% level is very short. Thus, the mean and variance results are close enough to the theoretical values to be acceptable in most applications.

# Critique

A better way to set up this experiment would be to pose a (null) hypothesis and then apply standard statistical methods to reject the hypothesis (or not). In addition, the number of samples could be varied from a small number to some very large number to examine the change in mean and variance as a function of number of samples; in theory, due to the Law of Large Numbers, this could show convergence properties.

# Log

A total of 27 minutes was spent performing the experiment in Matlab and writing the report.