

ECE3522 Practicum 1 : Testing Microprocessors

Penalty will be imposed after 3/1/21 10:00 pm (1 point each hour; fraction rounds up)

The sample Matlab code in the Appendix deals with a toss of an unfair coin. It has a 70% of probability to show head (denoted as $Y=0$), and 30% of the probability as tail (denoted as $Y=1$). The simulated probability mass function, the expected value, and standard deviation are evaluated using 1,000 repeated trials.

Now consider a discrete random variable X that represents the testing results of 1,000 microprocessors. Suppose that there are four grades $\{4, 3, 2, 1\}$ with the following probability mass function (PMF):

Grade	$X = 4$	$X = 3$	$X = 2$	$X = 1$
Probability	0.4	0.3	0.2	0.1

The grade of each microprocessor is independent of any other microprocessors.

You are required to

1. Generate a data sequence of 1,000 random integers between 1 and 4, representing the outcomes of testing results of 1,000 microprocessors that follow the PMF specified above. Report the number of microprocessors in these four grades and plot the relative frequency of each grade, which should be close to the probabilities specified in the above PMF table.
2. Using the above simulated results, compute and report the following values: average value, standard deviation, and conditional probability $P(X = 3|X \geq 2)$.
3. Analytically (use the equations, not through simulations) compute and report the following values: expected value (mean), standard deviation, and conditional probability $P(X = 3|X \geq 2)$.
4. Compare to the simulated results reported in step 2 and the respective analytical results reported in step 3. Are they close? If you run the experiments 10,000 times (instead of 1,000 times) and compute the values in step 2 again, shall you expect closer results to those reported in step 3?

Submit by e-mail to ece3522.temple@gmail.com

(a) A single Word or pdf file containing materials in the following order:

- Your name, TUID
- All the required values, figures, and observations. All plots must be properly labelled.
- Key references (website, book, paper, or name of collaborated students) if any
- Matlab codes

(b) All Matlab codes in .m format

Important: The Matlab code must be included in the Word or pdf file report, AND as a separate attachment. The name of the Word or pdf file must be in the following format with a proper file extension: Lastname_Firstname _pracitcum1_ECE3522 .

Requirements

Each student should complete the practicum separately. No group work is allowed.

A student can seek help, but the report must be his/her work and thus he/she must understand every word and every line of Matlab code reported. Copy and paste the Matlab codes from others work or from online resources are not permitted.

Appendix

```
%% ===== Matlab code sample for Practicum 1 =====  
% Simulation: Tossing an unfair coin
```

```
clear
```

```
n = 1000; % Number of tosses
```

```
range_y = [0:1];
```

```
for ii=1:n  
    y(ii) = (rand>0.7);  
end
```

```
figure(1)  
hist_y = hist(y, range_y);  
bar(range_y,hist_y/n);  
xlabel('Value of face Y')  
ylabel('Relative frequency')
```

```
mean_y = sum(y)/n;  
std_y = sqrt(sum((y-mean_y).^2)/n);
```

```
fprintf('The mean value of Y is %5.3f\n',mean_y);  
fprintf('The standard deviation of Y is %5.3f\n', std_y);
```

Outcomes:

The mean value is 0.279

The standard deviation is 0.449

