CE93 Spring 2017
MIDTERM 1

02/16/2017

Name:_____

Problem 1: ____ / 40 pts

Problem 2: ____ / 30 pts

Problem 3: ____ / 30 pts

_____

Total: ____ / 100 pts

1. Computer chips are manufactured on a production line. Of the manufactured chips, 30% are known to be defective. Diagnostic tools for the production line try to detect if the chips are defective (positive result) or not defective (negative result), but are known to make two kinds of errors:
    - False positive: A defect is detected, but the chip is not defective.
    - False negative: A defect is not detected, but the chip is defective.

   These diagnostic tools are known to have 15% false negatives for defective products, and 20% false positives for non-defective products.

   a. Draw a Venn diagram for the events described.

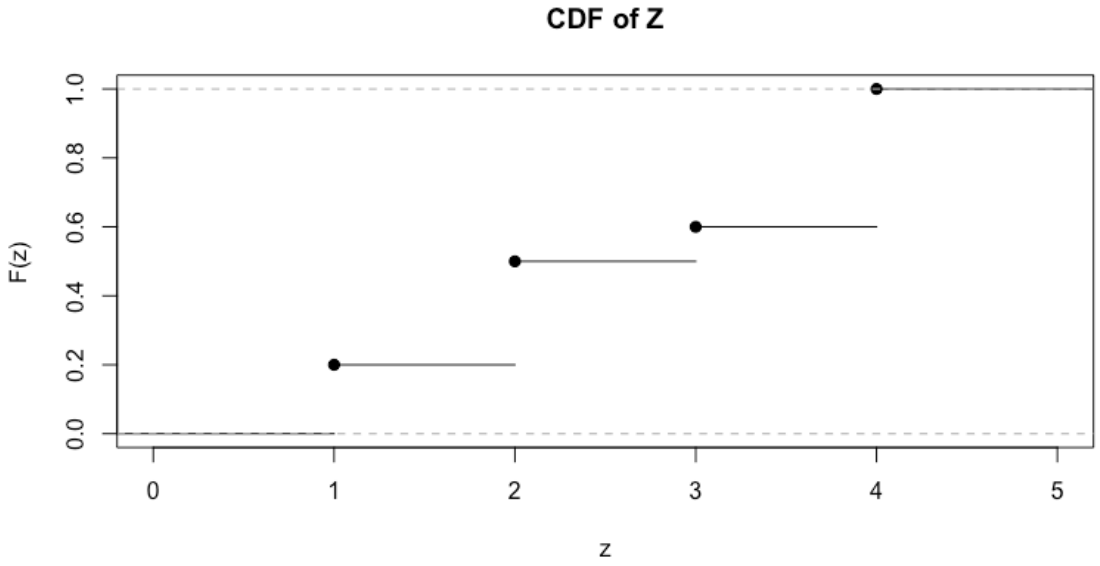
   b. Draw a tree diagram for the events described.

   c. What is the probability that the diagnostic tools make an error?

   d. A defect alert was issued for a chip just coming off the production line. What is the probability for a real defect?

   e. Creative engineers wish to improve the diagnostics. They ask for your advice on where to invest their efforts. What would you recommend to them?

2. Below is a CDF plot for the random variable Z.



a. Compute the mean of Z.

b. Compute the variance of Z.

3. In Lab 3, we looked at rainfall data in San Francisco over 1960-2002 with two variables: the number of rainy days per year and the cumulative yearly rainfall in inches. Below, there is MATLAB code to assess if the events of there being more than 65 rainy days and there being more the 22in of rain are dependent or independent.

```
%% Load data
clear; close all; clc
load('SFrainfall.dat');
days=SFrainfall(:,1);  % # of rainy days in a season
rain=SFrainfall(:,2);  % seasonal rainfall

%% Calculating probability of events
nTotal = length(days); % number of samples
nE1 = sum(days>65);    % E1: number of days > 65
Pr_E1 = nE1/nTotal;    % Pr(E1)

nE2 = sum(rain>22);    % E2: number of rainfall > 22
Pr_E2 = nE2/nTotal;    % Pr(E2)

%% Testing the relationship of events
nE1E2 = sum(days>65 & rain>22);  % intersection
Pr_E1E2 = nE1E2/nTotal;          % Pr(E1&E2)

disp(Pr_E1*Pr_E2)
disp(Pr_E1E2)
```

The results of executing this code is:

```
    0.2612
    0.3953
```

a. What can you conclude from the code results about the dependence of these two events?

b. How would you modify the code to test if the events are mutually exclusive?