ECE 341 - Homework #4

Binomial and Uniform Distributions. Due Monday, May 24th

Please make the subject "ECE 341 HW#4" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

Binomial Distribution

Assume you toss a coin with a probability of a heads being 0.7

$$X(z) = \left(\frac{0.3z+0.7}{z}\right)$$

1) Determine the probability of tossing 6 heads in 8 tosses

$$p = \binom{8}{6}(0.7)^6(0.3)^2 = 0.2965$$

2) Determine the probability distribution when tossing this same coin 8 times

Using Matlab and convolution

```
>> n1 = [0.3,0.7]

0.3000    0.7000

>> n2 = conv(n1,n1)

0.0900    0.4200    0.4900

>> n4 = conv(n2,n2)

0.0081    0.0756    0.2646    0.4116    0.2401

>> n8 = conv(n4,n4)

  0         1         2         3         4         5         6         7         8
0.0001    0.0012    0.0100    0.0467    0.1361    0.2541    0.2965    0.1977    0.0576

>>
```

NOAA has been keeping track of world weather for the past 141 years. 8 of the last 10 years have been the hottest on record. (the two that were not came in at #11 and #16).

3a) What is the probability of any given year being one of the 10 hottest on record (i.e. what is p?)

p = 10/141

3b) What is the probability of 8 of the last 10 years being the hottest on record? (i.e. toss a coin and get 9 heads out of 10 tosses)

$$p = \binom{10}{8}\left(\frac{10}{141}\right)^8\left(\frac{131}{141}\right)^2 = 0.000000024864$$

The odds are 40.2 million : 1 against this happening by chance.

Uniform Distribution

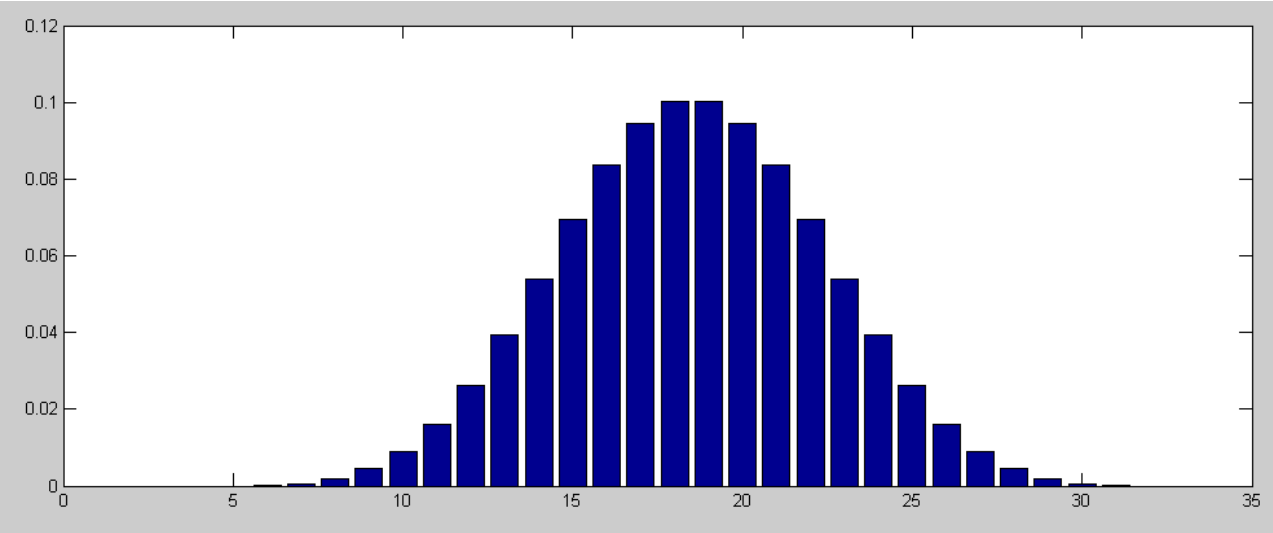
Assume a fair six-sided die:

$$Y(z) = \left(\frac{1}{6}\right)\left(\frac{z^5+z^4+z^3+z^2+z+1}{z^6}\right)$$

4) Asume you sum five dice (5d6). Determine the

- pdf
- mean, and
- standard deviation

```
>> d1 = [0,1,1,1,1,1,1]';
>> d1 = [0,1,1,1,1,1,1]' / 6;
>> d2 = conv(d1,d1);
>> d4 = conv(d2,d2);
>> d5 = conv(d1,d4);
>> bar(d5)
```



The mean is

$$\bar{x} = \sum x \cdot p(x)$$

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>> x = sum(N .* d5)
    x = 17.5000
```

The standard deviation is

$$s^2 = \sum p(x) \cdot (x - \bar{x})^2$$

```
>> s2 = sum(d5 .* ( (N - x).^2 ) )
s2 =   14.5833   the variance

>> s = sqrt(s2)
 s =   3.8188    the standard deviation
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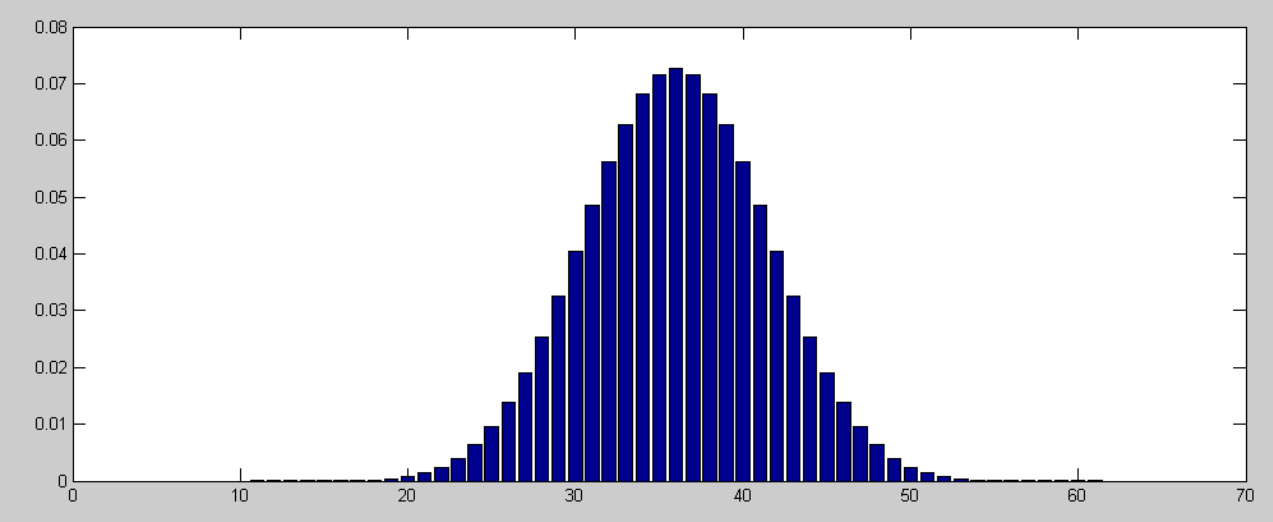
5) Asume you sum ten dice (10d6). Determine the

- pdf
- mean, and
- standard deviation




```
>> d1 = [0,1,1,1,1,1,1]';
>> d1 = [0,1,1,1,1,1,1]' / 6;
>> d2 = conv(d1,d1);
>> d4 = conv(d2,d2);
>> d8 = conv(d4,d4);
>> d10 = conv(d2,d8);

>> bar(d10)


>> N = [0:60]';
>> x = sum(N .* d10)

x =   35.0000          the mean

>> s2 = sum(d10 .* ( (N - x).^2 ) )

s2 =   29.1667         the variance

>> s = sqrt(s2)

s =    5.4006          the standard deviation

>>
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