

1. A question on a proficiency test is multiple choice with four possible answers, one of which is correct. Assuming that all responses are random guesses, find the probability that among 12 test subjects, exactly five answer the question correctly.

$$n = 12$$

$$x = 5$$

$$p = .25$$

$$q = .75$$

$$P(x) = {}_n C_x p^x q^{n-x}$$

$$P(x = 5) = {}_{12} C_5 (.25)^5 (.75)^7$$

$$= 0.1032$$

```
binomPdf(12,.25,
5)
.1032414436
```

2. Find the mean, standard deviation, and variance for the accompanying probability distribution.

x	P(x)	x * P(x)	x ² * P(x)
0	0.18	0.00	0.00
1	0.21	0.21	0.21
2	0.23	0.46	0.92
3	0.17	0.51	1.53
4	0.21	0.84	3.36
		2.02	6.02

mean:

2.02

$$\mu = \sum x * P(x) = 2.02$$

standard deviation:

1.393

$$\sigma = \sqrt{\sum x^2 * P(x) - \mu^2}$$

variance:

1.9396

$$= \sqrt{6.02 - 2.02^2}$$

$$= \sqrt{1.9396} = 1.393$$

L1	L2	L3	Z
0	.18		
1	.21		
2	.23		
3	.17		
4	.21		

L2(6) =			

```
1-Var Stats
x=2.02
Σx=2.02
Σx²=6.02
Sx=
σx=1.392695229
↓n=1
```

3. In conducting certain stress analysis tests, forces of 5000 pounds are applied to cables. The cables are tested in a batch of 12 and an average of 5% of the cables fail. Find . . .

(a) the mean number of failures per batch.

a. 0.60

$$n = 12 \quad \mu = np = 12 (.05) = 0.60$$

$$p = 0.05$$

$$q = 0.95$$

(b) the standard deviation for the number of failures per batch.

b. 0.775

$$n = 12 \quad \sigma = \sqrt{n * p * q} = \sqrt{12 * 0.05 * 0.95} = 0.775$$

$$p = 0.05$$

$$q = 0.95$$

(c) the probability that in the batch of 12 cables, exactly two will fail.

c. 0.0988

$$n = 12$$

$$x = 2 \quad P[x = 2] = {}_{12}C_2 * (.05)^2 (.95)^{10} = 0.0988$$

$$p = 0.05$$

$$q = 0.95$$

```
binompdf(12,.05,
2)
.098791595
```

(d) the probability that in the batch of 12 cables, at least three will fail.

d. 0.0196

$$n = 12$$

$$P[at.least.3] = P[x \geq 3]$$

$$x \geq 3$$

$$P[x = 3] = {}_{12}C_3 * (.05)^3 (.95)^9 = 0.0173$$

$$p = 0.05$$

$$P[x = 4] = {}_{12}C_4 * (.05)^4 (.95)^8 = 0.0021$$

$$q = 0.95$$

$$P[x = 5] = {}_{12}C_5 * (.05)^5 (.95)^7 = 0.0002$$

$$P[x = 6] = {}_{12}C_6 * (.05)^6 (.95)^6 = 0.0000$$

$$\Sigma = 0.0196$$

```
binompdf(12,.05,
(3,4,5,6,7,8,9,10,11,12))
(.0173318588 .0021
sum(Ans)
.019568262
```

4. A contractor has a 0.60 probability of making \$80,000, a 0.30 probability of losing \$10,000, and a 0.10 probability of breaking even. What is the expected value?

x	P(x)	x * P(x)
80 K	0.6	48.0
0	0.1	0.0
-10 K	0.3	-3.0

$$\Sigma = 45.0 \text{ K}$$

$$E(x) = \mu = \Sigma x * P(x)$$

$$= 45 \text{ K or } \$45,000 \text{ profit}$$

5. An Educational Testing Corporation has designed a standard test of mechanical aptitude. Scores on this test are normally distributed with a mean of 75 and a standard deviation of 15.

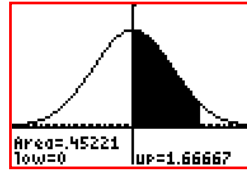
- (a) If the subject is randomly selected and tested, find the probability that his score will be between 75 and 100.

a. 0.4522

$$z = \frac{x - \mu}{\sigma} = \frac{75 - 75}{15} = 0.00$$

$$z = \frac{x - \mu}{\sigma} = \frac{100 - 75}{15} = 1.66$$

```
(75-75)/15
0
(100-75)/15
1.666666667
normalcdf(0,Ans)
.4522096691
```



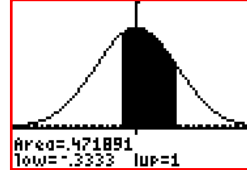
- (b) If the subject is randomly selected and tested, find the probability that his score will be between 70 and 90.

b. 0.4719

$$z = \frac{x - \mu}{\sigma} = \frac{70 - 75}{15} = -0.33$$

$$z = \frac{x - \mu}{\sigma} = \frac{90 - 75}{15} = 1.00$$

```
(70-75)/15
-.3333333333
(90-75)/15
1
normalcdf(-.3333,1)
.4718907572
```

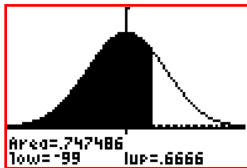


- (c) If the subject is randomly selected and tested, find the probability that his score will be below 85.

c. 0.7475

$$z = \frac{x - \mu}{\sigma} = \frac{85 - 75}{15} = 0.66$$

```
(85-75)/15
.6666666667
normalcdf(-99,Ans)
.747507533
```

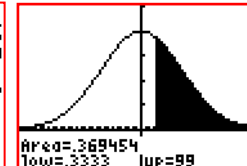


- (d) If the subject is randomly selected and tested, find the probability that his score will be greater than 80.

d. 0.3694

$$z = \frac{x - \mu}{\sigma} = \frac{80 - 75}{15} = 0.33$$

```
(80-75)/15
.3333333333
normalcdf(Ans,99)
.3694414037
```



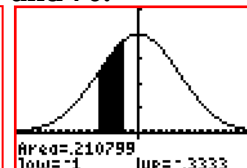
- (e) If the subject is randomly selected and tested, find the probability that his score will be between 60 and 70.

e. 0.2108

$$z = \frac{x - \mu}{\sigma} = \frac{60 - 75}{15} = -1$$

$$z = \frac{x - \mu}{\sigma} = \frac{70 - 75}{15} = -0.33$$

```
(60-75)/15
-1
(70-75)/15
-.3333333333
normalcdf(-1,Ans)
.2107861441
```



- (f) Find D_6 , the score which separates the lower 60% from the top 40%

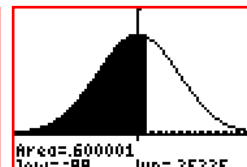
f. 78.80

$$z = \frac{x - \mu}{\sigma}$$

$$.2533 = \frac{x - 75}{15}$$

$$x = .2533(15) + 75 = 78.80$$

```
invNorm(.6000)
.2533471011
.2533*15+75
78.7995
```

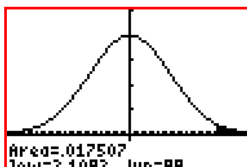


- (g) If 40 different applicants are randomly selected, find the probability that their mean is above 80

g. 0.0175

$$z = \frac{x - \mu}{\sigma} = \frac{-75}{15/\sqrt{40}} = 2.108$$

```
(80-75)/(15/√(40))
2.108185107
normalcdf(Ans,99)
.0175074283
```



6. Twenty percent of all families own stocks. Find the probability that in a random sample of 600 families, 125 or more will own stocks

$$\begin{aligned} n &= 600 \\ x &\geq 125 \\ p &= .20 \\ q &= .80 \end{aligned}$$

$$\begin{aligned} \mu &= np = (600)(0.20) = 120 \\ \sigma &= \sqrt{n * p * q} = \sqrt{600 * 0.2 * 0.8} = 9.8 \end{aligned}$$

or

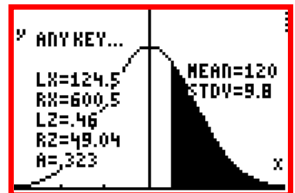
$$z = \frac{124.5 - 120}{9.8} = 0.46$$

$$P(x \geq 125) = 0.3228$$

```
(124.5-120)/√(600
0*.2*.8)
:4592793268
normalcdf(Ans,-99
)
.3230168113
```

```
NORM APPX OF BIN
ENTER...
N=600
P=.2
LOW X=125
HIGH X=600
```

```
ANY KEY...
EST PROB=
.3230
MEAN=120.0000
STD DEV=9.7980
N=600 P=.20
```



or $1 - \text{binomcdf}(600, .20, 124) = .3202$

7. In a county of North Florida, the conviction rate for speeding is 80%. Find the probability that of the next 10 speeding summonses issued, there will be at least 8 convictions.

$$\begin{aligned} n &= 10 \\ x &\geq 8 \\ p &= 0.80 \\ q &= 0.20 \end{aligned} \quad \begin{aligned} P(X \geq 8) &= P(8) + P(9) + P(10) \\ &= 0.3020 + 0.2684 + 0.1074 \\ &= 0.6778 \end{aligned}$$

```
binomPdf(10,.80,
{8,9,10})
(.301989888 .26...
sum(Ans)
.6777995264
```

8. Six hundred employees are tested for the time required to assemble a part. The results are normally distributed with a mean of 18.4 minutes and a standard deviation of 2.4 minutes. If a sample of 50 of these employees is randomly selected, find the probability that the mean of this sample group is below 18.0 minutes.

Population

$$N = 600$$

$$\mu = 18.4$$

$$\sigma = 2.4$$

$$z = \frac{x - \mu}{\sigma_{\bar{x}}} = \frac{18.0 - 18.4}{.325} = -1.23$$

$$P[< 18.0] = 0.1093$$

```
2.4/√(50)√(550/5
99)
.3252326764
(18.0-18.4)/Ans
-1.22988872
```

```
normalcdf(-99,-1
.23)
.1093486167
```

Sample – Central.Limit.Theorem

$$n = 50$$

$$\mu_{\bar{x}} = \mu = 18.4$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} * \sqrt{\frac{N-n}{N-1}} = \frac{2.4}{\sqrt{50}} * \sqrt{\frac{600-50}{600-1}} = 0.325$$