**Chapter 6**

**Continuous Probability Distributions**

**Learning Objectives**

1. Understand the difference between how probabilities are computed for discrete and continuous random variables.

2. Know how to compute probability values for a continuous uniform probability distribution and be able to compute the expected value and variance for such a distribution.

3. Be able to compute probabilities using a normal probability distribution. Understand the role of the standard normal distribution in this process.

4. Be able to use the normal distribution to approximate binomial probabilities.

5. Be able to compute probabilities using an exponential probability distribution.

6. Understand the relationship between the Poisson and exponential probability distributions.

**Solutions:**

1. a.



b. *P*(*x* = 1.25) = 0. The probability of any single point is zero since the area under the curve above any single point is zero.

c. *P*(1.0  *x*  1.25) = 2(.25) = .50

d. *P*(1.20 < *x* < 1.5) = 2(.30) = .60

2. a.



b. *P*(*x* < 15) = .10(5) = .50

c. *P*(12  *x*  18) = .10(6) = .60

d. 

e. 

3. a.



b. *P*(*x*  130) = (1/20) (130 - 120) = 0.50

c. *P*(*x* > 135) = (1/20) (140 - 135) = 0.25

d. minutes

4. a.



b. *P*(.25 < *x* < .75) = 1 (.50) = .50

c. *P*(*x*  .30) = 1 (.30) = .30

d. *P*(*x* > .60) = 1 (.40) = .40

5. a. Length of Interval = 310.6 - 284.7 = 25.9



b. Note: 1/25.9 = .0386

*P(x* < 290) = .0386(290 - 284.7) = .2046

c. *P*(*x*  300) = .0386(310.6 - 300) = .4092

d. *P*(290  *x*  305) = .0386(305 - 290) = .5790

e. *P*(*x*  290) = .0386(310.6 - 290) = .7952

Rounding up, we conclude that 80 of the top 100 golfers drive the ball this far.

6. a. *f*(*x*) =  for 18 < *x* < 26, 0 elsewhere.

*P*(*x*  25) = (26 – 25) = .125

b. *P*(21  *x*  25) = (25 – 21) = .50

c. This occurs when programming is 20 minutes or less

*P*(*x*  20) = (20 – 18) = .25

7. a. *P*(10,000  *x* < 12,000) = 2000 (1 / 5000) = .40

The probability your competitor will bid lower than you, and you get the bid, is .40.

b. *P*(10,000  *x* < 14,000) = 4000 (1 / 5000) = .80

c. A bid of $15,000 gives a probability of 1 of getting the property.

d. Yes, the bid that maximizes expected profit is $13,000.

The probability of getting the property with a bid of $13,000 is

*P*(10,000  *x* < 13,000) = 3000 (1 / 5000) = .60.

The probability of not getting the property with a bid of $13,000 is .40.

The profit you will make if you get the property with a bid of $13,000 is $3000 = $16,000 - 13,000. So your expected profit with a bid of $13,000 is

EP ($13,000) = .6 ($3000) + .4 (0) = $1800.

If you bid $15,000 the probability of getting the bid is 1, but the profit if you do get the bid is only $1000 = $16,000 - 15,000. So your expected profit with a bid of $15,000 is

EP ($15,000) = 1 ($1000) + 0 (0) = $1,000.

8.



9. a.



b. .683 since 45 and 55 are within plus or minus 1 standard deviation from the mean of 50 (Use the table or see characteristic 7a of the normal distribution).

c. .954 since 40 and 60 are within plus or minus 2 standard deviations from the mean of 50 (Use the table or see characteristic 7b of the normal distribution).



10.

a. *P*(*z*  1.5) = .9332

b. *P*(*z*  1.0) = .8413

c. *P*(1  *z*  1.5) = *P*(*z*  1.5) - *P*(*z* < 1) = .9932 - .8413 = .0919

d. *P*(0 < *z* < 2.5) = *P*(*z* < 2.5) - *P*(*z*  0) = .9938 - .5000 = .4938

11. a. *P*(*z*  -1) = .1587

b. *P*(*z* ≥ -1) = 1 - *P*(*z* < -1) = 1 - .1587 = .8413

1. *P*(*z* ≥ -1.5) = 1 - *P*(*z* < -1.5) = 1 - .0668 = .9332

d. *P*(-2.5 ≤ *z*) = 1 - *P*(*z* < -2.5) = 1 - .0062 = .9938

e. *P*(-3 < *z* ≤ 0) = *P*(*z* ≤ 0) - *P*(*z* ≤ -3) = .5000 - .0013 = .4987

12. a. *P*(0 ≤ *z* ≤ .83) = .7967 - .5000 = .2967

b. *P*(-1.57 ≤ *z* ≤ 0) = .5000 - .0582 = .4418

c. *P*(*z* > .44) = 1 - .6700 = .3300

d. *P*(*z* ≥ -.23) = 1 - .4090 = .5910

e. *P*(*z* < 1.20) = .8849

f. *P*(*z*  ≤ -.71) = .2389

13. a. *P*(-1.98  *z*  .49) = *P*(*z*  .49) - *P*(*z* < -1.98) = .6879 - .0239 = .6640

b. *P*(.52  *z*  1.22) = *P*(*z*  1.22) - *P*(*z* < .52) = .8888 - .6985 = .1903

c. *P*(-1.75  *z*  -1.04) = *P*(*z*  -1.04) - *P*(*z* < -1.75) = .1492 - .0401 = .1091

14. a. The *z* value corresponding to a cumulative probability of .9750 is *z* = 1.96.

b. The *z* value here also corresponds to a cumulative probability of .9750: *z* = 1.96.

c. The *z* value corresponding to a cumulative probability of .7291 is *z* = .61.

d. Area to the left of *z* is 1 - .1314 = .8686. So *z* = 1.12.

e. The *z* value corresponding to a cumulative probability of .6700 is *z* = .44.

f. The area to the left of *z* is .6700. So *z* = .44.

15. a. The *z* value corresponding to a cumulative probability of .2119 is *z* = -.80.

b. Compute .9030/2 = .4515; *z* corresponds to a cumulative probability of .5000 + .4515 = .9515. So *z* = 1.66.

c. Compute .2052/2 = .1026; *z* corresponds to a cumulative probability of .5000 + .1026 = .6026. So *z* = .26.

d. The *z* value corresponding to a cumulative probability of .9948 is *z* = 2.56.

e. The area to the left of *z* is 1 - .6915 = .3085. So *z* = -.50.

16. a. The area to the left of *z* is 1 - .0100 = .9900. The *z* value in the table with a cumulative probability closest to .9900 is *z* = 2.33.

b. The area to the left of *z*  is .9750. So *z* = 1.96.

c. The area to the left of *z* is .9500. Since .9500 is exactly halfway between .9495 (*z* = 1.64) and .9505(*z* = 1.65), we select *z* = 1.645. However, *z* = 1.64 or *z* = 1.65 are also acceptable answers.

d. The area to the left of *z*  is .9000. So *z* = 1.28 is the closest *z* value.

17. Let *x* = debt amount

*μ* = 15,015, *σ* = 3540

a. 

*P*(*x* > 18,000) = 1- *P*(*z* ≤ .84) = 1 - .7995 = .2005

b. 

*P*(*x* < 10,000) = *P*(*z* < -1.42) = .0778

c. At 18,000, *z* = .84 from part (a)

At 12,000, 

*P*(12,000 < *x* < 18,000) = *P*(-.85 < *z* < .84) = .7995 - .1977 = .6018

d. 

*P*(*x* ≤ 14,000) = *P*(*z* ≤ -.29) = .3859

18. *μ* = 14.4 and *σ* = 4.4

a. At *x* = 20, 

*P*(*z* ≤ 1.27) = .8980

*P*(*x*  20) = 1 - .8980 = .1020

b. At *x* = 10, 

*P*(*z*  ≤ -1.00) = .1587

So, *P*(*x* ≤ 10) = .1587

c. A *z*-value of 1.28 cuts off an area of approximately 10% in the upper tail.

*x* = 14.4 + 4.4(1.28) = 20.03

A return of 20.03% or higher will put a domestic stock fund in the top 10%

19. *μ* = 328 and *σ* = 92

a. 

*P*(*x* > 500) = *P*(*z* > 1.87) = 1 - *P*(*z* ≤ 1.87) = 1 - .9693 = .0307

The probability that the emergency room visit will cost more than $500 is .0307.

b. 

*P*(*x* < 250) = *P*(*z* < -.85) = .1977

The probability that the emergency room visit will cost less than $250 is .1977.

c. For *x* = 400, 

For *x* = 300, 

*P*(300 < *x* < 400) = *P*(*z*  < .78) - *P*(*z*  < -.30) = .7823 - .3821 = .4002

The probability that the emergency room visit will cost between $300 and $400 is .4002.

d. The lower 8%, or area = .08, occurs for *z* = -1.41

= 328 – 1.41(92) = $198.28

For a patient to have a charge in the lower 8%, the cost of the visit must have been $198.28 or less.

20. a. United States: 

At *x* = 3.50, 

*P*(*z* < -.92) = .1788

So, *P*(*x* < 3.50) = .1788

b. Russia: 

At *x* = 3.50, 

*P*(*z* < .50) = .6915

So, *P*(*x* < 3.50) = .6915

69.15% of the gas stations in Russia charge less than $3.50 per gallon.

c. Use mean and standard deviation for Russia.

At *x* = 3.73, 





The probability that a randomly selected gas station in Russia charges more than the mean price in the United States is .0495. Stated another way, only 4.95% of the gas stations in Russia charge more than the average price in the United States.

21. From the normal probability tables, a *z*-value of 2.05 cuts off an area of approximately .02 in the upper tail of the distribution.

*x* = *μ* + *zσ* = 100 + 2.05(15) = 130.75

A score of 131 or better should qualify a person for membership in Mensa.

22. Use *μ* = 8.35 and *σ* = 2.5

1. We want to find *P*(5 ≤ *x* ≤10)

At *x* = 10,



At *x* = 5,



*P*(5 ≤ *x* ≤ 10) = *P*(-1.34 ≤ *z* ≤ .66)= *P*(*z* ≤ .66) - *P*(*z* ≤ -1.34)

= .7454 - .0901

= .6553

The probability of a household viewing television between 5 and 10 hours a day is .6553.

1. Find the *z*-value that cuts off an area of .03 in the upper tail. Using a cumulative probability of

1 - .03 = .97, *z* = 1.88 provides an area of .03 in the upper tail of the normal distribution.

*x* = *μ* + *zσ* = 8.35 + 1.88(2.5) = 13.05 hours

A household must view slightly over 13 hours of television a day to be in the top 3% of television viewing households.

c. At *x* = 3, 

*P*(*x*>3) = 1 - *P*(*z*< -2.14) = 1 - .0162 = .9838

The probability a household views more than 3 hours of television a day is .9838.

23. a.  *P*(*z* ≤ -2) = .0228. So *P*(*x* < 60) = .0228

b. At *x* = 60

 Area to left is .0228

At *x* = 75

 Area to left is .3085

*P*(60 ≤ *x* ≤ 75) = .3085 - .0228 = .2857

c.  *P*(*z* ≤ 1) = *P*(*x* ≤ 90) = .1587

Therefore 15.87% of students will not complete on time.

(60) (.1587) = 9.52

We would expect 9 or 10 students to be unable to complete the exam in time.

24. a. 



We will use as an estimate of *μ* and *s* as an estimate of *σ* in parts (b) - (d) below.

b. Remember the data are in thousands of shares.

At *x* = 180



*P*(*x* ≤ 180) = *P*(*z* ≤ -.77) = .2206

The probability trading volume will be less than 180 million shares is .2206.

c. At *x* = 230



*P*(*x* > 230) = *P*(*z* > 1.15) = 1 - *P*(*z* ≤ 1.15) = 1 - .8749 = .1251

The probability trading volume will exceed 230 million shares is .1251.

d. A *z*-value of 1.645 cuts off an area of .05 in the upper tail

*x* = *μ* + *zσ* = 200 + 1.645(26.04) = 242.84

If the early morning trading volume exceeds 242.84 million shares, the day is among the busiest 5%.

25. *μ* = 6.8, *σ* = .6

a. At *x* = 8, 

*P*(*x* > 8) = *P*(*z* > 2.0) = 1 - .9772 = .0228

b. At *x* = 6, 

*P*(*x* ≤ 6) = *P*(*z* ≤ -1.33) = .0918

c. At *x* = 9, 

At *x* = 7, 

*P*(7 < *x* < 9) = *P*(.33 < *z* < 3.67) = 1 - .6293 = .3707

Only 37.07 percent of the population gets the amount of sleep recommended by doctors. Most get less.

26. a. ***np* = 100(.20) = 20

***np* (1 - *p*) = 100(.20) (.80) = 16



b. Yes because *np* = 20 and *n* (1 - *p*) = 80

c. *P*(23.5  *x*  24.5)

 *P* (*z*  1.13) = .8708

 *P* (*z*  .88) = .8106

*P*(23.5  *x*  24.5) = .8708 - .8106 = .0602

d. *P*(17.5  *x*  22.5)

 *P* (*z*  .63) = .7357

 *P* (*z*  -.63) = .2643

*P*(17.5  *x*  22.5) = .7357 - .2643 = .4714

e. *P*(*x*  15.5)



*P*(*x*  15.5) = *P* (*z*  -1.13) = .1292

27. a. ***np* = 200(.60) = 120

***np* (1 - *p*) = 200(.60) (.40) = 48



b. Yes since *np* = 120 and *n* (1 - *p*) = 80

c. *P*(99.5  *x*  110.5)

 *P* (*z*  -1.37) = .0853

 *P* (*z*  -2.96) = .0015

*P*(99.5  *x*  110.5) = .0853 - .0015 = .0838

d. *P*( *x*  129.5)

 *P* (*z* ≥ 1.37) = 1 - .9147 = .0853

*P*(*x*  129.5) = .0853

e. Simplifies computation. By direct computation of binomial probabilities we would have to compute

*P*(*x*  130) = *f* (130) + *f* (131) + *f* (132) + *f* (133) + ...

28. a. ** = *np* = (250)(.20) = 50

b. *σ*2 = *np*(1-*p*) = 250(.20)(1-.20) = 40



Allowing for the continuity correction factor, 

At *x* = 39.5, 



c. Allowing for the continuity correction factor, 

At *x* = 54.5, 

At *x* = 60.5, 



d. Allowing for the continuity correction factor, 

At *x* = 69.5, 



29. a.

*n* = 8, *p =* .82











b. ** = *np* = (80)(.82) = 65.6

*σ*2 = *np*(1-*p*) = 80(.82)(1-.82) = 11.808



Allowing for the continuity correction factor, 

At *x* = 59.5, 



c. The advantage of using the normal approximation of the binomial distribution is that it eases and simplifies the calculations required to obtain the desired probability. For part (b) with *n* = 80, we would have had to compute *f*(60) + *f*(61) + *f*(62) + … + *f*(80) using the binomial probability function *f*(*x*). This would have been tedious and time consuming.

d. Students may be tempted to say that with the speed of computers, the developers of statistical software would be able to use the binomial probability function *f*(*x*) as described in part (c) and compute the exact probability rather than the normal approximation. However, developers of statistical software are also interested in fast, efficient, and easy to program computational procedures provided such procedures provide reliable and accurate answers. With a large number of trials, the normal approximation of the binomial probability distribution is very good. Statistical software developers may chose to use the normal approximation of the binomial probability distribution in some statistical routines. For example, Minitab uses the normal approximation of binomial probabilities in the Nonparametric sign test whenever *n* is greater than 50.

30. a. ***np* = 800(.18) = 144

b. ***np* = 600(.18) = 108



For *x* < 100, use the continuity correction to find *P*(*x*  99.5)

At *x* = 99.5,

 *P* (*z* < -.90) = .1841

*P*(*x*  99.5) = .1841

The probability that less than 100 individuals will be under 18 years of age is .1841.

c. 

For *x* = 200 or more, use the continuity correction to find *P*(*x* ≥ 199.5)

At *x* = 199.5,

 *P* (*z* ≥ -2.53) = 1 - .0057 = .9943

*P*(*x* ≥ 199.5) = .9943

The probability that 200 or more individuals will be over 59 is .9943.

31. a. ***np* = 120(.79) = 94.8



The probability that at least 85 employers provide a two-day Thanksgiving holiday = *P*(*x* 84.5).

At *x* =84..5



Therefore, 

b. Find the normal probability: 

At *x* = 100.5



*P*(*x*100.5) = *P*(*z*1.28) = .8997

At *x* = 89.5,



*P*(*x* 89.5) = *P*(*z* -1.19) = .1170

Therefore, = .8997 - .1170 = .7827

c. ***np* = 120(.19) = 22.8



The probability less than 20 employers provide a one-day Thanksgiving holiday = *P*(*x* 19.5).

At *x* = 19..5



Therefore, 

32. a. *P*(*x*  6) = 1 - *e*-6/8 = 1 - .4724 = .5276

b. *P*(*x*  4) = 1 - *e*-4/8 = 1 - .6065 = .3935

c. *P*(*x*  6) = 1 - *P*(*x*  6) = 1 - .5276 = .4724

d. *P*(4  *x*  6) = *P*(*x*  6) - *P*(*x*  4) = .5276 - .3935 = .1341

33. a. 

b*. P*(*x*  2) = 1 - *e*-2/3 = 1 - .5134 = .4866

c. *P*(*x*  3) = 1 - *P*(*x*  3) = 1 - (1 - **) = *e*-1 = .3679

d. *P*(*x*  5) = 1 - *e*-5/3 = 1 - .1889 = .8111

e. *P*(2  *x*  5) = *P*(*x*  5) - *P*(*x*  2) = .8111 - .4866 = .3245

34. a. With **

b. *P*(*x* ≤ 15) =  = .5276

c. *P*( *x* > 20) = 1 - *P*(*x* ≤ 20)

= 1 - (1 -) = 

d. With **



35. a.



b. *P*(*x*  12) = 1 - *e*-12/12 = 1 - .3679 = .6321

c. *P*(*x*  6) = 1 - *e*-6/12 = 1 - .6065 = .3935

d. *P*(*x*  30) = 1 - *P*(*x* < 30)

= 1 - (1 - *e*-30/12)

= .0821

36. a.  for *x* > 0

*P*(*x* < *x*0) = 

*P*(*x* < 1) =  = 1 - .6065 = .3935

b. *P*(*x* < 2) = = 1 - .3679 = .6321

= .6321 - .3935 = .2386

c. For this customer, the cable service repair would have to take longer than 4 hours.

= 1

37. a.  for *x* > 0

*P*(*x* < *x*0) = 

*P*(*x* < 20) =  1 - .4493 = .5507

b. *P*(*x* 30) = 1 - *P*(*x*  30) = 1 - (1 - *e*-30/25) = *e*-1.2 = .3012

c. For the customer to make the 15-minute return trip home by 6:00 p.m., the order must be ready by 5:45 p.m. Since the order was placed at 5:20 p.m., the order must to be ready within 25 minutes.

*P*(*x* 25) = 1 - = 1 - = 1 - .3679 = .6321

This may seem surprising high since the mean time is 25 minutes. But, for the exponential distribution, the probability *x* being greater than the mean is significantly less than the probability of *x* being less than the mean. This is because the exponential distribution is skewed to the right.

38. a. If the mean number of interruptions per hour follows the Poisson distribution, the time between interruptions follows the exponential distribution. So,

** = of an hour and 

Thus, *f* (*x*) = .

Here *x* is the time between interruptions in hours.

b. Fifteen minutes is 1/4 of an hour so,



The probability of no interruptions during a15-minute period is .2528.

c. Since 10 minutes is 1/6 of an hour, we compute,



Thus, the probability of being interrupted within 10 minutes is .6002.

39. a. Let *x* = sales price ($1000s)



b. *P*(*x*  215) = (1 / 25) (225 - 215) = .40

c. *P*(*x* < 210) = (1 / 25)(210 - 200) = .40

d. *E* (*x*) = (200 + 225)/2 = 212,500

If the executive leaves the house on the market for another month, the expected sales price will be $2,500 higher than if the house is sold back to the company for $210,000. However, if the house is left on the market for another month, there is a .40 probability that the executive will get less than the company offer of $210,000. It is a close call. But the expected value of $212,500 suggests the executive should leave the house on the market another month.

40. a. Find the *z* value that cuts off an area of .10 in the lower tail.

From the standard normal table *z* ≈ -1.28. Solve for *x*,



*x* = 19,000 – 1.28(2100) = 16,312

10% of athletic scholarships are valued at $16,312 or less.

b. 

*P*(*x* ≥ 22,000) = 1 – *P*(*z* ≤ 1.43) = 1 - .9236 = .0764

7.64% of athletic scholarships are valued at $22,000 or more.

c. Find the *z* value that cuts off an area of .03 in the upper tail: *z* = 1.88. Solve for *x*,



*x* = 19,000 + 1.88(2100) = 22,948

3% of athletic scholarships are valued at $22,948 or more.

41. a. *P*(*defect*) = 1 - *P*(9.85  *x*  10.15)

= 1 - *P*(-1  *z*  1) = 1 - .6826 = .3174

Expected number of defects = 1000(.3174) = 317.4

b. *P*(*defect*) = 1 - *P*(9.85  *x*  10.15)

= 1 - *P*(-3  *z*  3) = 1 - .9974 = .0026

Expected number of defects = 1000(.0026) = 2.6

c. Reducing the process standard deviation causes a substantial reduction in the number of defects.

42. *μ* = 658

a. *z* = -1.88 cuts off .03 in the lower tail

So,





b. At 700, 

At 600, 

*P*(600 < *x* < 700) = *P*(-2.31 < *z* < 1.65) = .9505 - .0104 = .9401

c. *z* = 1.88 cuts off approximately .03 in the upper tail

*x* = 658 + 1.88(25.5319) = 706.

On the busiest 3% of days 706 or more people show up at the pawnshop.

43. a. ** = 670 ** = 30

All rooms will be rented if demand is at least 700.

At *x* = 700



*P*(*x* ≥ 700) = *P*(*z* ≥ 1) = 1 - *P*(*z* < 1) = 1 - .8413 = .1587

b. 50 or more rooms will be unrented is demand falls to 650 or less.

At *x* = 650



*P*(*x* ≤ 650) = *P*(*z* ≤ -.67) = .2514

c. A promotion might be a good idea if it isn’t too expensive. Things to consider:

* The probability of renting all the rooms without a promotion is approximately .16.
* The probability is about .25 that 50 or more rooms will go unrented. This is significant lost revenue.
* To be successful, a promotion should increase the expected value of demand above 670.

44. a. At *x* = 200



*P*(*x* > 200) = *P*(*z* > 2) = 1 - *P*(*z* ≤ 2) = 1 - .9772 = .0228

b. Expected Profit = Expected Revenue - Expected Cost

= 200 - 150 = $50

45.* * = 1550 ** = 300

a. At *x* = 1000,



*P*(*x* < 1000) = *P*(*z* < -1.83) = .0336

b. At *x* = 2000,



*P*(*x* < 2000) = *P*(*z* < 1.50) = .9332

*P*(*x* < 1000) = .0336 (from part (a))

*P*(1000 < *x* < 2000) = .9332 - .0336 = .8996

c. Find the *z* value that cuts off an area of .05 in the upper tail: *z* = 1.645

Solve for *x*,



*x* = 1550 + 1.645(300) = 2043.5

Rounding up, we would say that 2044 or more crashes would put a year in the top 5% for fatal crashes. It would be a bad year.

46. a. At 400,



Area to left is .3085

At 500,



Area to left is .6915

*P*(400 ≤ *x*  ≤ 500) = .6915 - .3085 = .3830

38.3% will score between 400 and 500.

b. At 630,



96.41% do worse and 3.59% do better .

c. At 480,



Area to left is .6179

38.21% are acceptable.

47. a. At 100,000



*P*(*x* > 100,000) = *P*(*z* > .57) = 1 - *P*(*z* ≤ .57) = 1 - .7157 = .2843

The probability of a Houston brand manager having a base salary in excess of $100,000 is .2843.

b. At 100,000



*P*(*x* > 100,000) = *P*(*z* > .12) = 1 - *P*(*z* ≤ .12) = 1 - .5478 = .4522

The probability of a Los Angeles brand manager having a base salary in excess of $100,000 is .4522

c. At *x* = 75,000



*P*(*x* < 75,000) = *P*(*z* < -1.03) = .1515

The probability of a Los Angeles brand manager receiving a base salary below $75,000 is small: .1515

d. The answer to this is the Houston brand manager base salary that cuts off an area of .01 in the upper tail of the distribution for Houston brand managers.

Use *z* = 2.33

*x* = 88,592 + 2.33(19,900) = 134,959

A Los Angeles brand manager who makes $134,959 or more will earn more than 99% of the Houston brand managers.

48. ** = .6

At 2%

*z* ≈ -2.05 *x* = 18

 

** = 18 + 2.05 (.6) = 19.23 oz.



The mean filling weight must be 19.23 oz.

49. Use normal approximation to binomial.

a. ** =  *np* = 50 (.75) = 37.5



At *x* = 42.5



*P*(*z*  1.63) = .9484

Probability of an A grade = 1 - .9484 = .0516 or 5.16% will obtain an A grade.

b. At *x* = 34.5



At *x* = 39.5



*P*(-.98  *z*  .65) = .7422 - .1635 = .5787

or 57.87% will obtain a C grade.

c. At *x* = 29.5



*P*(*z*  -2.61) = 1 - .0045 = .9955

or 99.55%of the students who have done their homework and attended lectures will pass the examination.

d. ** =  *np* = 50 (.25) = 12.5 (We use *p* = .25 for a guess.)



At *x* = 29.5



*P*(*z*  5.55)  0

Thus, essentially no one who simply guesses will pass the examination.

50. a. ** =  *np* = (240)(0.49) = 117.6

Expected number of wins is 117.6

Expected number of losses = 240(0.51) = 122.4

Expected payoff = 117.6(50) - 122.4(50) = (-4.8)(50) = -240.

The player should expect to lose $240.

b. To lose $1000, the player must lose 20 more hands than he wins. With 240 hands in 4 hours, the player must win 110 or less in order to lose $1000. Use normal approximation to binomial.

** =  *np* = (240)(0.49) = 117.6



Find *P*(*x*  110.5)

At *x* = 110.5



*P*(*x*  110.5) = .1788

The probability he will lose $1000 or more is .1788.

c. In order to win, the player must win 121 or more hands.

Find *P*(*x*  120.5)

At *x* = 120.5



*P*(*x*  120.5) = 1 - .6443 = .3557

The probability that the player will win is .3557. The odds are clearly in the house’s favor.

d. To lose $1500, the player must lose 30 hands more than he wins. This means he wins 105 or fewer hands.

Find *P*(*x*  105.5)

At *x* = 105.5



*P*(*x*  105.5) =.0594

The probability the player will go broke is .0594.

51. a. Given 

Compute for *µ*= 5.8, 6.2 and 7.0









*µ* = 6.6 provides the closest probability to 

b. 

c. 



The probability that a worker uses the office computer between four and eight hours is

52. a. Mean time between arrivals = 1/7 minutes

b. *f* (*x*) = 7*e*-7*x*

c. *P*(*x* > 1) = 1 - *P*(*x* < 1) = 1 - [1 - *e*-7(1)] = *e*-7 = .0009

d. 12 seconds is .2 minutes

*P*(*x* > .2) = 1 - *P*(*x* < .2) = 1- [1- *e*-7(.2)] = *e*-1.4 = .2466

53. a.  for *x* > 0

b. *P*(*x* < *x*0) = 

*P*(*x* < 40) =  1 - .3519= .6481

*P*(*x* < 20) =  1 - .5932 = .4068

*P*(20 < *x* < 40) = *P*(*x* < 40) - *P*(*x* < 20) = .6481 - .4068 = .2413

c. *P*(*x* > 60) = 1 - *P*(*x* < 60) = 

54. a.  therefore ** = 2 minutes = mean time between telephone calls

b. Note: 30 seconds = .5 minutes

*P*(*x*  .5) = 1 - *e*-.5/2 = 1 - .7788 = .2212

c. *P*(*x*  1) = 1 - *e*-1/2 = 1 - .6065 = .3935

d. *P*(*x*  5) = 1 - *P*(*x* < 5) = 1 - (1 - *e*-5/2) = .0821