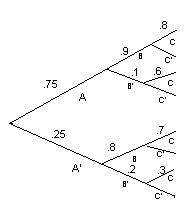
2.38

* 1. There are 6 75W bulbs and 9 other bulbs. So, *P*(select exactly 2 75W bulbs) = *P*(select exactly 2 75W bulbs and 1 other bulb) =.
  2. *P*(all three are the same rating) = *P*(all 3 are 40W or all 3 are 60W or all 3 are 75W) = .
  3. *P*(one of each type is selected) =.
  4. It is necessary to examine at least six bulbs if and only if the first five light bulbs were all of the 40W or 60W variety. Since there are 9 such bulbs, the chance of this event is

.

2.63



* 1. From the top path of the tree diagram, *P*(*A* ∩ *B* ∩ *C*) = (.75)(.9)(.8) = .54.
  2. Event *B* ∩ *C* occurs twice on the diagram: *P*(*B* ∩ *C*) = *P*(*A* ∩ *B* ∩ *C*) + *P*(*A*′ ∩ *B* ∩ *C*) = .54 + (.25)(.8)(.7) = .68.
  3. *P*(*C*) = *P*(*A* ∩ *B* ∩ *C*) + *P*(*A*′ ∩ *B* ∩ *C*) + *P*(*A* ∩ *B*′ ∩ *C*) + *P*(*A*′ ∩ *B*′ ∩ *C*) = .54 + .045 + .14 + .015 = .74.
  4. Rewrite the conditional probability first: *P*(*A* | *B* ∩ *C*) = .

2.93

Apply the addition rule: *P*(*A*∪*B*) = *P*(*A*) + *P*(*B*) – *P*(*A* ∩ *B*) ⇒ .626 = *P*(*A*) + *P*(*B*) – .144. Apply independence: *P*(*A* ∩ *B*) = *P*(*A*)*P*(*B*) = .144.

So, *P*(*A*) + *P*(*B*) = .770 and *P*(*A*)*P*(*B*) = .144.

Let *x* = *P*(*A*) and *y* = *P*(*B*). Using the first equation, *y* = .77 – *x*, and substituting this into the second equation yields *x*(.77 – *x*) = .144 or *x*2 – .77x + .144 = 0. Use the quadratic formula to solve:

*x* = = .32 or .45. Since *x* = *P*(*A*) is assumed to be the larger probability, *x* = *P*(*A*) = .45 and *y* = *P*(*B*) = .32.

2.101

Let *A* = 1st functions, *B* = 2nd functions, so *P*(*B*) = .9, *P*(*A* ∪ *B*) = .96, *P*(*A* ∩ *B*)=.75. Use the addition rule: *P*(*A* ∪ *B*) = *P*(*A*) + *P*(*B*) – *P*(*A* ∩ *B*) ⇒ .96 = *P*(*A*) + .9 – .75 ⇒ *P*(*A*) = .81.

Therefore, *P*(*B* | *A*) = = .926.

3.52

Let *X* be the number of students who want a new copy, so *X* ~ Bin(*n* = 25, *p* = .3).

* 1. *E*(*X*) = *np* = 25(.3) = 7.5 and *SD*(*X*) = = 2.29.
  2. Two standard deviations from the mean converts to 7.5 ± 2(2.29) = 2.92 & 12.08. For *X* to be more than two standard deviations from the means requires *X* < 2.92 or *X* > 12.08. Since *X* must be a non-negative integer, *P*(*X* < 2.92 or *X* > 12.08) = 1 – *P*(2.92 ≤ *X* ≤ 12.08) = 1 – *P*(3 ≤ *X* ≤ 12) =

1 – = 1 – .9736 = .0264.

3.80

Solutions are found using the cumulative Poisson table, *F*(*x; μ*) = *F*(*x*; 4).

* 1. *P*(*X* ≤ 4) = *F*(4; 4) = .629, while *P*(*X* < 4) = *P*(*X* ≤ 3) = *F*(3; 4) = .434.
  2. *P*(4 ≤ *X* ≤ 8) = *F*(8; 4) – *F*(3; 4) = .545.
  3. *P*(*X* ≥ 8) = 1 – *P*(*X* < 8) = 1 – *P*(*X* ≤ 7) = 1 – *F*(7; 4) = .051.
  4. For this Poisson model, *μ* = 4 and so *σ* = = 2. The desired probability is *P*(*X* ≤ *μ + σ*) = *P*(*X* ≤ 4 + 2) = *P*(*X* ≤ 6) = *F*(6; 4) = .889.

3.97

* 1. From the description, *X* ~ Bin(15, .75). So, the pmf of *X* is *b*(*x*; 15, .75).
  2. *P*(*X* > 10) = 1 – *P*(*X* ≤ 10) = 1 – *B*(10;15, .75) = 1 – .314 = .686.
  3. *P*(6 ≤ *X* ≤ 10) *= B*(10; 15, .75) – *B*(5; 15, .75) = .314 – .001 = .313.
  4. *μ* = (15)(.75) = 11.75, *σ*2= (15)(.75)(.25) = 2.81.
  5. Requests can all be met if and only if *X* ≤ 10, and 15 – *X* ≤ 8, i.e. iff 7 ≤ *X* ≤ 10. So,

*P*(all requests met) = *P*(7 ≤ *X* ≤ 10) = *B*(10; 15, .75) – *B*(6; 15, .75) = .310.

4.28.

* 1. *P*(0 ≤ *Z* ≤ 2.17) = Φ(2.17) – Φ(0) = .4850.
  2. Φ(1) – Φ(0) = .3413.
  3. Φ(0) – Φ(–2.50) = .4938.
  4. Φ(2.50) – Φ(–2.50) = .9876.
  5. Φ(1.37) = .9147.
  6. *P*( –1.75 < *Z*) + [1 – *P*(*Z* < –1.75)] = 1 – Φ(–1.75) = .9599.
  7. Φ(2) – Φ(–1.50) = .9104.
  8. Φ(2.50) – Φ(1.37) = .0791.
  9. 1 – Φ(1.50) = .0668.
  10. *P*(|*Z*| ≤ 2.50) = *P*(–2.50 ≤ *Z* ≤ 2.50) = Φ(2.50) – Φ(–2.50) = .9876.

4.29

* 1. .9838 is found in the 2.1 row and the .04 column of the standard normal table so *c* = 2.14.
  2. *P*(0 ≤ *Z* ≤ *c*) = .291 ⇒ Φ(*c*) – Φ(0) = .2910 ⇒ Φ(*c*) – .5 = .2910 ⇒ Φ(*c*) = .7910 ⇒ from the standard normal table, *c* = .81.
  3. *P*(*c* ≤ *Z*) = .121 ⇒ 1 – *P*(*Z* < *c*) = .121 ⇒ 1 – Φ(*c*) = .121 ⇒ Φ(*c*) = .879 ⇒ *c* = 1.17.
  4. *P*(–*c* ≤ *Z* ≤ *c*) = Φ(*c*) – Φ(–*c*) = Φ(*c*) – (1 – Φ(*c*)) = 2Φ(*c*) – 1 = .668 ⇒ Φ(*c*) = .834 ⇒

*c* = 0.97.

* 1. *P*(*c* ≤ |*Z*|) = 1 – *P*(|*Z*| < *c*) = 1 – [Φ(*c*) – Φ(–*c*)] = 1 – [2Φ(*c*) – 1] = 2 – 2Φ(*c*) = .016 ⇒ Φ(*c*) = .992 ⇒ *c* = 2.41.

4.105

* 1. *P*(*X* > 100) = 1 
  2. *P*(50 < *X* < 80) = = Φ(–1.5) – Φ(–3.29) = .1271 – .0005 = .1266.
  3. Notice that *a* and *b* are the 5th and 95th percentiles, respectively. From the standard normal table, Φ(*z*) = .05 ⇒ *z* = –1.645, so –1.645 is the 5th percentile of the standard normal distribution. By symmetry, the 95th percentile is *z* = 1.645. So, the desired percentiles of this distribution are *a* = 96 + (–1.645)(14) = 72.97 and *b* = 96 + (1.645)(14) = 119.03. The interval (72.97, 119.03) contains the central 90% of all grain sizes.

4.106

* 1. *F*(*x*) = 0 for *x* < 1 and *F*(*x*) = 1 for *x* > 3. For 1 ≤ *x* ≤ 3, .
  2. *P*(*X* ≤ 2.5) = *F*(2.5) = 1.5(1 – .4) = .9; *P*(1.5 ≤ *X* ≤ 2.5) = *F*(2.5) – *F*(1.5) = .4.
  3. *E*(*X*) = 
  4. *E*(*X*2) = , so *V*(*X*) = *E*(*X*2) – [*E*(*X*)]2 = .284 and *σ* =.553.
  5. From the description, *h*(*x*) = 0 if 1 ≤ *x* ≤ 1.5; *h*(*x*) = *x* – 1.5 if 1.5 ≤ *x* ≤ 2.5 (one second later), and *h*(*x*) = 1 if 2.5 ≤ *x* ≤ 3. Using those terms,

.

5.22

* 1. = (0 + 0)(.02) + (5 + 0)(.04) + … + (10 + 15)(.01) = 14.10.

Note: It can be shown that *E*(*X + Y*) always equals *E*(*X*) + *E*(*Y*), so in this case we could also work out the means of *X* and *Y* from their marginal distributions: *E*(*X*) = 5.55, *E*(*Y*) = 8.55, so *E*(*X + Y*) = 5.55 + 8.55 = 14.10.

* 1. For each coordinate, we need the maximum; e.g., max(0,0) = 0, while max(5,0) = 5 and max(5,10) = 10. Then calculate the sum: =

max(0,0)(.02) + max(5,0)(.04) + … + max(10,15)(.01) = 0(.02) + 5(.04) + … + 15(.01) = 9.60.

* 1. If *X* > 15, then more people want new copies than the bookstore carries. At the other end, though, there are 25 – *X* students wanting used copies; if 25 – *X* > 15, then there aren’t enough used copies to meet demand.

The inequality 25 – *X* > 15 is the same as *X* < 10, so the bookstore can’t meet demand if either *X* > 15 or *X* < 10. All 25 students get the type they want iff 10 ≤ *X* ≤ 15:

*P*(10 ≤ *X* ≤ 15) = = .1890.

* 1. The bookstore sells *X* new books and 25 – *X* used books, so total revenue from these 25 sales is given by *h*(*X*) = 100(*X*) + 70(25 – *X*) = 30*X* + 1750. Using linearity/rescaling properties, expected revenue equals *E*(*h*(*X*)) = *E*(30*X* + 1750) = 30*μ* + 1750 = 30(7.5) + 1750 = $1975.