

**1E**, p. 198: The second row of the transition matrix should have been 0.2, 0.6, 0.2.

$$\begin{array}{l} \text{State 1} \\ \text{State 2} \\ \text{State 3} \end{array} \begin{pmatrix} 0.4 & 0.5 & 0.1 \\ 0.2 & \mathbf{0.6} & \mathbf{0.2} \\ 0.3 & 0.1 & 0.6 \end{pmatrix}$$

**1I**, page 349, sol. 4.84: (d) The probability of a local showing up at time  $t$ , and that this is the first train, in other words no expresses have shown up is proportional to:

$$\text{Prob}[\text{No express by } t] \text{ Prob}[\text{local at } t] = (e^{-5t}) (15e^{-15t}) = 15 e^{-20t}.$$

In order to get the conditional density of this event, we need to divide by its integral from zero to infinity, which is  $15/20 = 3/4$ . Thus the conditional density is:  $20 e^{-20t}$ .

Thus the distribution of this event is an Exponential with mean  $1/20$  hours = 60 minutes /20 = 3 minutes, the same as the distribution of waiting times for the first train, regardless of type.

By similar reasoning, conditional on the first train to show up being a express, the conditional distribution of its time of arrival is also an Exponential with mean 3 minutes.

(e) For your coworker to take the fourth train to arrive, there must have been three locals followed by an express. From the previous solution, the average waiting time for the arrival time of the first local, conditional on the first train being a local, is Exponential with mean 3 minutes.

Since the Poisson processes have no memory, the interevent time between the first local and second local, conditional on the first and second trains being local, follows an independent, identically distributed Exponential to the waiting time to the first local.

Similarly, the next interevent time is also an independent, identically distributed Exponential.

Since the Poisson processes have no memory, the time from the 3rd local to the express is the same as the conditional distribution of the time of arrival of the first train conditional on it being an express; thus it is also an Exponential with mean 3 minutes.

So the conditional time your coworker has to wait is the sum of 4 independently distributed Exponentials, each with mean 3.

Thus his conditional waiting time has the same distribution as waiting for the 4th event from a Poisson with rate  $1/3$  minutes; for this Poisson, the mean number of events by 30 minutes is:  $30/3 = 10$ .

$$\text{Prob}[\text{coworker waited more than 30 minutes}] = \text{Prob}[\text{fewer than 4 events from a Poisson } \lambda = 10] = e^{-10} + 10e^{-10} + 10^2e^{-10}/2 + 10^3e^{-10}/6 = \mathbf{1.034\%}.$$

$$\mathbf{1L}$$
, page 442, sol. 14.74:  $P = \frac{-0.12 \pm \sqrt{0.12^2 - (4)(0.2)(-0.144)}}{(2) \mathbf{(0.2)}} \Rightarrow P = 0.6.$

**1L**, page 449, sol. 15.24: **A.**  $(1, 0, 0)Q = (0.7, 0.2, 0.1) =$  distribution in 2006.  
 $(0.7, 0.2, 0.1)Q = (0.54, 0.35, 0.11) =$  distribution in 2007.  
 $(0.54, 0.35, 0.11)Q = (0.4535, 0.443, 0.1045) =$  distribution in 2008.  
 Average payment during 2006 is:  $(0.7)(25) + (0.2)(50) + (0.1)(100) = 37.5$ .  
 Average payment during 2007 is:  $(0.54)(25) + (0.35)(50) + (0.11)(100) = 42$ .  
 Average payment during 2008 is:  $(0.4535)(25) + (0.443)(50) + (0.1045)(100) = 43.9125$ .  
 Actuarial present value:  $37.5/(1.05)^{0.5} + 42/(1.05)^{1.5} + 43.9125/(1.05)^{2.5} = \mathbf{114.502}$ .

**1L**, page 455, sol. 15.45, the alternate solution was wrong:  
 Alternately, if a well is Normal in a year, then it has a 50% chance of remaining Normal next year, and a 50% of becoming Dry next year and never paying dividends again.

Thus if a well is Normal this year, it has a 1/2 chance of being Normal next year, a 1/4 chance of being Normal in two years, a 1/8 chance of being Normal in 3 years, etc.

Therefore, if the well is Normal, then the APV of dividends is:

$$200\{1/1.1 + (1/2)(1/1.1^2) + (1/2^2)(1/1.1^3) + (1/2^3)(1/1.1^4) + \dots\}$$

$$= (200)(1/1.1)\{1 - (1/2)(1/1.1)\} = (200)/(1.1 - 0.5) = 333.33.$$

If a well is a Gusher in a year, then it has a 50% chance of remaining a Gusher next year, a 30% of becoming Normal next year and never being a Gusher again, and a 20% of becoming Dry next year and never being a Gusher again

Thus if a well is a Gusher this year, it has a 1/2 chance of being a Gusher next year, a 1/4 chance of being a Gusher in two years, a 1/8 chance of being a Gusher in 3 years, etc.

Therefore, if the well is a Gusher, then the APV of dividends from Gusher years is:

$$1000\{1/1.1 + (1/2)(1/1.1^2) + (1/2^2)(1/1.1^3) + (1/2^3)(1/1.1^4) + \dots\}$$

$$= (1000)(1/1.1)\{1 - (1/2)(1/1.1)\} = (1000)/(1.1 - .5) = 1666.67.$$

If a well is a Gusher, then there is a 30% chance it becomes Normal next year, a  $(0.5)(0.3)$  chance it first becomes Normal the year after that, a  $(0.5^2)(0.3)$  chance it first becomes Normal the year after that, etc.

When the well becomes Normal the Actuarial Present Value of future dividends is 333.33.

Therefore, if the well is a Gusher, then the APV of dividends from Normal years is:

$$333.33\{0.3/1.1 + (0.3)(0.5)(1/1.1^2) + (0.3)(0.5^2)(1/1.1^3) + (0.3)(0.5^3)(1/1.1^4) + \dots\}$$

$$= (333.33)(0.3)(1/1.1)\{1 - (1/2)(1/1.1)\} = (100)/(1.1 - .5) = 166.67.$$

Thus, if the well is a Gusher, then the total APV of dividends is:

$$1666.67 + 166.67 = \mathbf{\$1833}.$$

**1N**, page 7, solution 8: Over **five** years

**1O**, page 1, Q.2: The states should be **zero**, one, two, and three.

**1R**, page 2, Q.5: Third interval should be 8 am - 10 am.

**2A**, p. 37, 5 lines from the bottom: 
$$\frac{2\theta^2}{(\alpha-1)(\alpha-2)} - \left(\frac{\theta}{\alpha-1}\right)^2 = \frac{\alpha\theta^2}{(\alpha-1)^2(\alpha-2)}$$

**2G**, page 256, Q. 17.17:  $H_1: \mu_1 > \mu_2$

**2I**, page 337, Q. 23.24:  $H_1: \sigma_x^2 > \sigma_y^2$

**2M**, page 453: Order Statistics is Section **35**.

**2M**, page 467, 4th paragraph:  $X_{(r)} = X_{(r-1)} + W_r/(N+1-r)$ ,  $r = 2, 3, \dots, N$ .

**2P**, page 577, sol. 2.50: **C**.  $E[X] = 8$ .  $E[X^2] = (2^2 + 10^2 + 12^2 + 8^2 + 8^2)/5 = 75.2$ .

Match the mean and variance. Set  $\alpha\theta = 8$ , and  $\alpha\theta^2 = 75.2 - 8^2 = 11.2$ .

$\Rightarrow \theta = 1.4$ .  $\Rightarrow \alpha = 8/1.4 = \mathbf{5.714}$ .

Alternately, match the first and second moments:  $\alpha\theta = 8$ , and  $\alpha(\alpha+1)\theta^2 = 75.2$ .

Solving,  $\theta = 1.4$ , and  $\alpha = \mathbf{5.714}$ .

**2T**, page 710, sol. 19.4: When getting the significance level, we pick  $\mu_0 = 11$ , the most extreme value (in the direction of  $H_1$ ) of  $\mu$  within the composite null hypothesis.

We will reject  $H_0$  if:  $\bar{X} \geq 11 + S/2$ .

When  $\bar{X} = 11 + S/2$ ,  $\bar{X} - \mu_0 = \bar{X} - 11 = S/2$ . Thus, the numerator of a t-statistic is  $S/2$ .

The denominator of a t-statistic is:  $\sqrt{S^2/16} = S/4$ .  $\Rightarrow t = \frac{S/2}{S/4} = 2$ .

**The MFE/3F CBT exam will provide a formula document as well as a normal distribution calculator that will be available during the test by clicking buttons on the item screen.**

Details are available on the Prometric Web Site.

[http://www.prometric.com/SOA/MFE3F\\_calculator.htm](http://www.prometric.com/SOA/MFE3F_calculator.htm)

“Similar to other exam reference buttons, the normal distribution calculator button will be available throughout the exam in the top right corner of every item screen. Click the button to call up the calculator and calculate cumulative normal distribution and inverse cumulative normal distribution values. Use these values to answer the question as needed.”

“When using the normal distribution calculator, values should be entered with five decimal places. Use all five decimal places from the result in subsequent calculations.”

(The normal distribution calculator button replaces the Normal Table.

The previous rule on rounding no longer applies.

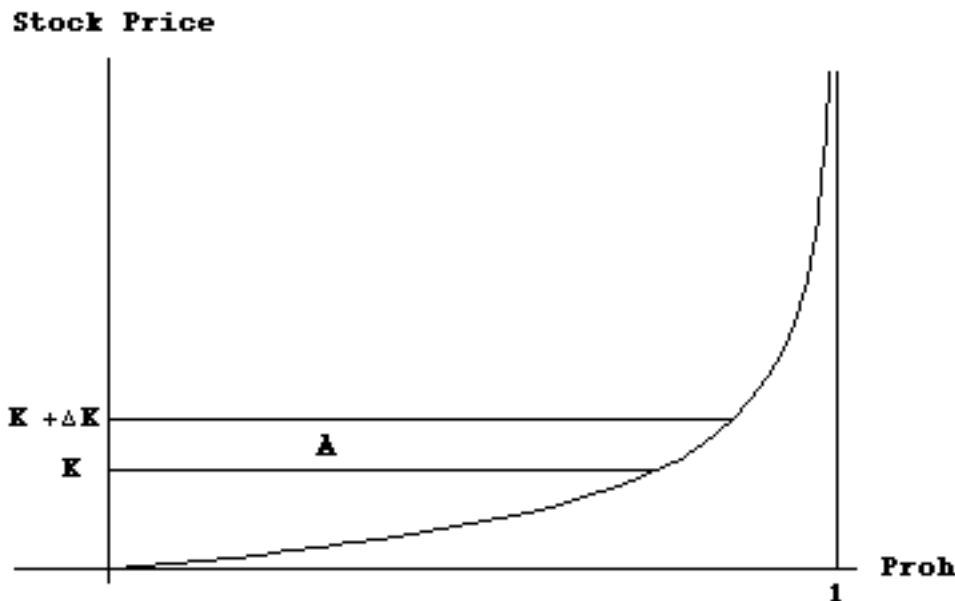
You can try the normal distribution calculator button at the Prometric Web Site.

You will benefit from using it at least part of the time when you are studying.

The formula sheet contains the same information about the Normal and LogNormal distributions as was provided in the past.)

**3B**, p.39, the graph near the top of the page was that for a put rather than a call.

For an increase in  $K$  of  $\Delta K$ , the value of the put increases by Area A in the following Lee Diagram:



**3C**, p.111, Q. 10.4: Should refer to ABC stock throughout.

**3D**, p.123, half way down the page:  $\Rightarrow \Delta = e^{-\delta h}(C_u - C_d) / (S_0u - S_0d)$ .

**3F**, p.195, 3rd paragraph:  $p = \frac{\exp[(\alpha - \delta)h] - d}{u - d} > \frac{\exp[(r - \delta)h] - d}{u - d} = p^*$ .

**3F**, p.197: question 17.12 totals to 9 points rather than 12.

**3F**, p.265:  $E[(K - S_T)_+] = E[K - S_T | S_T < K] \text{Prob}[S_T < K] + 0 \text{Prob}[S_T \geq K]$   
 $= K \text{Prob}[S_T < K] - E[S_T | S_T < K] \text{Prob}[S_T < K] = K \Phi[-d_2] - S_0 \exp[(\alpha - \delta)t] \Phi[-d_1]$ .

**3H**, p. 267, footnote 352: See pages 299 and 609 of Derivatives Markets by McDonald.

**3H**, p. 282, near bottom: Let  $y_t$  is the number Euros needed to buy one dollar at time t.

**3J**, p. 343, lines 1 and 2:  $\frac{\exp[-(d_1 - \sigma\sqrt{T})^2 / 2]}{\sqrt{2\pi}} = \exp[d_1 \sigma\sqrt{T}] \exp[-\sigma^2 T / 2] \frac{\exp[-d_1^2 / 2]}{\sqrt{2\pi}}$   
 $= \exp[\ln(S) - \ln(K) + (r - \delta + \sigma^2/2)T] \exp[-\sigma^2 T / 2] \phi[d_1] = \phi[d_1] (S/K) e^{(r - \delta)T}$ .

**3J**, p. 371-2: The call premium at the up node is:  $e^{-0.06/2} \{(0.502)(21) + (0.498)(4.5)\} = 12.41$ .

The call premium at the down node is:  $e^{-0.06/2} \{(0.502)(4.5) + (0.498)(0)\} = 2.19$ .

$\Delta_0 = \exp[-0.005] (12.41 - 2.19) / (110 - 95) = 0.678$ .

$4.5 = 7.10 + (4.5)(0.678) + (4.5)^2(0.0454)/2 + (2)(1/2)\theta$ .

$\Rightarrow \theta = -6.11$ . This would be theta on an annual basis.

If instead we want theta on a daily basis, then  $\theta = -6.11/365 = -0.0167$ .

**3P**, p. 579, 5th paragraph:  $Z(t+s) - Z(t)$  is Normal with mean 0, variance s,

**3Q**, p. 617, 7b: If in the risk neutral environment:  $d[\ln S(t)] = (r - \delta - \sigma^2/2) dt + \sigma d\tilde{Z}(t)$ .

**3W**, p. 833, Q. 74.12: D. 0.906 E. 0.907

**3W**, p. 835, 3rd paragraph:  $\exp[2\sigma_1 \sqrt{h}]$ , where  $\sigma_1$

**FinEconSols**, p. 928, Q. 4.27, last few line of my comment:  $(S - K)_+ - (K - S)_+ = S - K$ .

Thus the payoff from buying a call and selling the similar put is:  $S - K$ .

Thus the payoff for this portfolio of puts and calls is:  $2(S_T - 60) - 3(S_T - 70) + (S_T - 90) = 0$ .

**FinEconSols**, p. 1114, Q. 40.30:

Under the true probability measure, in other words in the actual environment, the return from time  $s$  to  $t$ ,  $\ln[S(t)/S(s)]$ , is Normal with mean:  $(\alpha - \delta - \sigma^2/2)(t - s)$ .

Thus from bullet (iii) we have:  $10\% = (\alpha - \delta - \sigma^2/2)(3 - 1) \Rightarrow 5\% = \alpha - \delta - \sigma^2/2$ .

Under the risk-neutral probability measure, in other words in the risk-neutral environment, the return from time  $s$  to  $t$ ,  $\ln[S(t)/S(s)]$ , is Normal with mean:  $(r - \delta - \sigma^2/2)(t - s)$ .

**FinEconSols**, p. 1138, Q. 46.14: = Premium for the **Put**, subject to rounding.

**FinEconSols**, p. 1222-1223: solutions 59.10 and 59.13 are reversed.

**FinEconSols**, p.1275, sol. 65.11: **A.**  $(90 - 75.84)_+ = 14.16$  .  $(90 - 88.85)_+ = 1.15$ .

The estimated premium of the put is:  $\{(14.16 + 1.15)/2\}/\exp[(2)(.05)] = \mathbf{6.93}$ .

**Financial Economics Practice Exam #3**, solution #25:

For  $S = 70$ ,  $d_1 = \{\ln(70/65) + (0.045 - 0.009 + 0.33^2/2)(0.5)\} / \{(0.33)\sqrt{0.5}\} = 0.5114$ .

For  $S = 74$ ,  $d_1 = \{\ln(74/65) + (0.045 - 0.009 + 0.33^2/2)(0.5)\} / \{(0.33)\sqrt{0.5}\} = 0.7495$ .