

ACTEX EXAM 5 STUDY MANUAL

December 15, 2010

Basic Claim Estimation Techniques volume

The first printing of the manuals contained a small number of pages with font errors. Attached are replacement pages.

Solutions are based on pp. 152–73.

A1. 1) Calculate link ratios:

$$LR_{2/1} = 2.0 \quad LR_{3/2} = 1.5$$

2) Calculate ultimate CDFs:

$$UCDF_1 = (2.0)(1.5) = 3.0$$

3) Calculate IBNR factors:

$$IBNRF = 1 - 1/UCDF$$

$$IBNRF_1 = 1 - 1/3 = 2/3$$

$$IBNRF_2 = 1 - 1/1.5 = 1/3$$

4) Estimate IBNR:

$$IBNR = \sum (ECR)(\text{Earned Premium})(\text{IBNR Factor})$$

$$IBNR = [.60][(2,000)(1/3) + (3,000)(2/3)] = 1,800$$

A2. $R = A(1 - 1/F)$

A3. $IBNR \text{ Factor} = 1 - 1/UCDF = 1 - 1/1.1 = 1/11$

Answer: C

A4. $IBNR = (ECR)(\text{Earned Premium})(\text{IBNR Factor}) = (.60)(1,000)(1/11) = 55$

$$\text{Unpaid Claims} = (\text{Reported Claims} - \text{Paid Claims}) + IBNR$$

$$UC = 500 - 300 + 55 = 255$$

Answer: A

A5. $IBNR \text{ Factor} = 1 - 1/UCDF = 1.0 - 1/1.15 = .130$

Answer: C

A6. 1) Calculate ultimate CDFs:

$$UCDF_{12} = (1.50)(1.25)(1.10)(1.05)(1.02)(.95) = 2.098$$

$$UCDF_{24} = (1.10)(1.05)(1.02)(.95) = 1.119$$

$$UCDF_{36} = (1.02)(.95) = .969$$

2) $IBNRF = 1 - 1/UCDF$

$$IBNRF_{12} = 1 - 1/2.098 = .523$$

$$IBNRF_{24} = 1 - 1/1.119 = .106$$

$$IBNRF_{36} = 1 - 1/.969 = -.032$$

3) Estimate IBNR:

$$IBNR = \sum (\text{Expected Claims})(\text{IBNR Factor})$$

$$IBNR = (1\bar{M})(-.032) + (1.5\bar{M})(.106) + (2\bar{M})(.524) = 1.175\bar{M}$$

- C7. a. Multiply the 1986 ECR by the ratio of the change in loss costs to the changes in rate level:
 Change in Rate Level = $(1.10)(1.08)(1.05) = 1.2474$
 Change in Loss Costs = $(1.07)^4 = 1.31080$
 $ECR_{90} = [ECR_{86}][(\text{Change in Rate Level})/(\text{Change in Loss Costs})] = (.650)(1.31080/1.2474)$
 $ECR_{90} = .683$
- b. 1) Calculate the IBNR factors:
 $IBNRF = 1 - 1/UCDF$ $IBNRF_{12} = 1 - 1/4.000 = .750$
 $IBNRF_{24} = 1 - 1/2.000 = .500$ $IBNRF_{36} = 1 - 1/1.428 = .300$
 $IBNRF_{48} = 1 - 1/1.250 = .200$ $IBNRF_{60} = 1 - 1/1.111 = .100$
- 2) Calculate IBNR:
 $IBNR_{90} = (ECR)(\text{Earned Premium})(IBNRF) = (.683)(6,000)(.500) = 2,049$
- 3) Calculate the ultimate claim ratio:
 $UCR_{90} = (\text{Reported Losses}_{90} + IBNR_{90})/(\text{Earned Premium}_{90})$
 $UCR_{90} = (2,600 + 2,049)/6,000 = .775$
- c. 1) Calculate the differences in IBNR factors:
 $\Delta IBNRF_{24-36} = .500 - .300 = .200$
- 2) Calculate IBNR emergence:
 $IBNRE = (ECR)(\text{Earned Premium})(\Delta IBNRF_{24-36})$
 $IBNRE_{90/92} = (.683)(6,000)(.200) = 820$
- C8. 1) Calculate the ultimate CDF at two years:
 $UCDF_2 = (1.20)(1.10) = 1.32$
- 2) Calculate the IBNR factors:
 $IBNRF = 1 - 1/UCDF$ $IBNRF_2 = 1 - 1/1.32 = .242$
 $IBNRF_3 = 1 - 1/1.10 = .091$
- 3) Calculate the difference in IBNR factors:
 $\Delta IBNRF_{2-3} = .242 - .091 = .151$
- 4) Calculate IBNR emergence:
 $IBNRE_{93/95} = (ECR)(\text{Earned Premium}_{93})(\Delta IBNRF_{2-3}) = (.50)(1,000)(.151) = 76,$
- C9. 1) Calculate the IBNR factors for 12 and 24 months:
 $IBNRF_{12} = 1 - 1/UCDF = 1 - 1/4.00 = .75$
 $IBNRF_{24} = 1 - 1/2.00 = .50$
- 2) Calculate the differences in IBNR factors:
 $\Delta IBNRF_{12-24} = .75 - .50 = .25$
- 3) Calculate IBNR emergence:
 $IBNRE_{94/95} = (ECR)(\text{Earned Premium}_{94})(\Delta IBNRF_{12-24}) = (.65)(1\bar{M})(.25) = 162,500,$
- C10. 1) Calculate the differences in IBNR factors:
 $\Delta IBNR_{12-24} = .384 - .210 = .174$ $\Delta IBNR_{24-36} = .210 - .083 = .127$
 $\Delta IBNR_{36-48} = .083 - .000 = .083$
- 2) Calculate IBNR emergence as of 6/30/95:
 IBNR Emergence = $\sum (ECR)(\text{Earned Premium})(\Delta \text{ in IBNR Factors})(\text{Quarter 2 Factor})$
 $IBNRE_{6/95} = [.75][(5,700)(.174)(.65) + (5,300)(.127)(.60) + (5,200)(.083)(.60)] = 981$
- 3) Calculate the IBNR balance as of 6/30/95:
 $IBNR \text{ Balance}_{6/95} = IBNR_{12/94} - IBNRE_{6/95} = 2,800 - 981 = 1,819$

Solutions are based on pp. 387–93.

- B1. a. Paid LAE is attributable to both known incurred and paid claims. Known incurred claims equal losses paid during the calendar year plus the calendar year change in the reserve for known losses. Since there are no reserve inaccuracies, the value of a paid loss equals that of the incurred value at end of its initial year. We thus get:

$$\text{Paid ULAE Attributable to Incurred Losses} = (r/2)(L + C)$$

$$\text{Paid ULAE Attributable to Paid Losses} = (r/2)(L)$$

$$\text{Total ULAE} = (r/2)(L + C) + (r/2)(L) = r(L + C/2)$$

- b. A more accurate factor would be the ratio of paid ULAE to the average of paid and incurred losses, which takes into account the relationship between ULAE paid and both openings and closings of loss reserves. When losses are increasing, this ratio is lower than the paid-to-paid ratio. In such a case, use of the latter ratio produces an overstated reserve.
- B2. His denominator equals one-half of the sum of paid losses and incurred losses and since incurred losses equal the sum of paid losses and the change in reserves, it also equals the sum of paid losses and one-half of the change in outstanding losses.

Answer: B

- B3. See B2.

Answer: B

- B4. 1) Calculate incurred losses:

$$\begin{aligned} \text{IL}_{85} &= \text{Paid Losses}_{85} + \text{Change in Reserves}_{84-85} \\ \text{IL}_{85} &= 10,000 + (15,000 - 13,000) = 12,000 \end{aligned}$$

- 2) Calculate the paid-to-paid/incurred ratio:

$$\text{Ratio} = \frac{\text{Paid ULAE}_{85}}{(1/2)(\text{Paid Losses}_{85} + \text{Incurred Losses}_{85})} = \frac{220}{(1/2)(10,000 + 12,000)} = .02$$

- 3) Calculate the ULAE reserve:

$$\begin{aligned} \text{ULAER}_{85} &= [\text{Ratio}][\text{Case Reserves}_{85} + \text{IBNR Reserve}_{85}] \\ \text{ULAER}_{85} &= [.02][(1/2)(12,000) + 3,000] = 180 \end{aligned}$$