4. (7.5 points)

Given the following information:

- The insurance company entered the market in State X at the beginning of 2008.
- All policies are annual.
- Rates will be in effect for 12 months beginning on July 1, 2014.
- Rate change history:
  - +5% effective July 1, 2010.
  - +7% effective April 1, 2012.
- Premiums are expected to increase at an inflationary rate of 2% annually.
- Annual loss cost trend = +4%.
- ULAE provision = 12% of loss and ALAE.
- Fixed expense ratio= 7%.
- Variable expense ratio = 21%.
- Underwriting profit and contingencies provision = 8%.
- To simplify calculations, assume premium is earned evenly throughout the year.
- Assume no loss development after 48 months.

Calendar Year	State X Earned Premium	State X Earned Exposures	State X Written Premium	State X Written Exposures
2010	$400,000	400	$630,000	600
2011	$2,200,000	2,000	$3,105,000	2,700
2012	$16,800,000	14,000	$18,750,000	15,000

	State X Incurred Losses and ALAE			
Accident Year	12 Months	24 Months	36 Months	48 Months
2008	$0	$200	$800	$1,000
2009	$50,000	$61,300	$78,200	$80,000
2010	$380,500	$587,000	$624,486	
2011	$671,600	$1,316,239		
2012	$9,706,667			

	Countrywide Incurred Losses and ALAE			
Accident Year	12 Months	24 Months	36 Months	48 Months
2007			$123,600,000	$125,000,000
2008		$62,700,000	$68,600,000	$70,000,000
2009	$75,000,000	$83,300,000	$88,200,000	$90,000,000
2010	$80,500,000	$87,000,000	$93,000,000	
2011	$71,600,000	$78,800,000		
2012	$86,900,000			

<QUESTION 4 CONTINUED ON NEXT PAGE>

4. (continued)

   a. (6.25 points)

      Calculate the indicated rate level change for State X using the loss ratio method. Use two-step trending to project premiums.

   b. (0.5 point)

      The assumption that the premium is earned evenly should not hold for State X given that it is a new book of business. Briefly describe two alternatives to the traditional parallelogram method that would improve the accuracy of the estimated projected premiums.

   c. (0.75 point)

      Fully discuss the impact to the rate level indication for State X by assuming the premium is earned evenly. Include the directional change to the rate level indication that would result if adjusting for the actual earning of the premium.

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Exam 5 – Question #4 Part A (example 1)

A.

Avg. factor	Adj. factor for earned
2010: 1/8(1.05) + 7/8(1) = 1.00625	1.1165
2011: 1/8(1) + 7/8(1.05) = 1.04375	1.0764
2012: 9/32(1.1235) + 23/32(1.05) = 1.070672	1.04934

Adj. for 2012 written = $\frac{1.1235}{\frac{1}{4}(1.05) + \frac{3}{4}(1.1235)} = 1.016627078$

2012 avg. written @ CRL = 18.75(1.016627078)/1500 = 1270.78

Year	Step 1 Prem = earned exp. 1270.78	Step 2 Trend	Final Prem
10	508313.54	$(1.02)^{2.5}$	534111.72
11	2541567.70	$(1.02)^{2.5}$	2670558.60
12	17790973.87	$(1.02)^{2.5}$	13593910.16
			Total = 21898580.48

Trend from 1/1/2010 – 7/1/2012 – 2.5 years

State x LDFs

AY	12-24	24-36	36-48
08	X	4	1.25
09	1.226	1.277	1.023
10	1.543	1.064	
11	1.96		

CW LDFs

AY	12-24	24-36	36-48
07	X	X	1.011
08	X	1.094	1.0204
09	1.111	1.059	1.0204
10	1.081	1.069	
11	1.101		
Avg. =	1.097	1.074	1.017

Because there is exp. growth in state X, and LDFs are volatile, should use more stable CW development factors. Use state X LDFS will skew projection (most likely too low due to older LDFs)

CW CDFS	12	24	36	48
	1.198	1.0923	1.017	1

Year	Loss + ALAE	CDF	ULAE	Trend	Find loss and LAE
10	624486	1.017	1.12	$(1.04)^5$	865422.89
11	1316239	1.0923	1.12	$(1.04)^4$	18833770.83
12	9706607	1.198	1.12	$(1.04)^3$	14650248.64

Total = 17399442.16

Trend from 7/1/10	to 7/1/15	5
	11	4 years
	12	3

LR = 0.7945

Rate change = $\frac{.7945 + .07}{1-.21-.03} - 1 = 21.77\%$

Exam 5 – Question #4 Part A (example 2)

Prem

- Need to bring to CRL CRL= 1.05(1.07) = 1.1235

10 avg. rate level = 1/8(1.05) + (1-1/8)(1) = 1.00625

10 OLF = $\frac{1.1235}{1.00625}$ = 1.11652

11 avg. rate level = 1/8(1.05) + 7/8(1.05) = 1.04375

11 OLF = $\frac{1.1235}{1.04375}$ = 1.07641

12 avg. rate level = .28125(1.1235) + (1-.28125)(1.05) = 1.07067

12 OLF = $\frac{1.1235}{1.07067}$ = 1.04934

10 OLF = $\frac{1.1235}{½(1) + ½(1.05)}$ = 1.0961

11 OLF = $\frac{1.1235}{1.05}$ = 1.07

12 OLF = $\frac{1.1235}{¼(1.05) + ¾(1.1235)}$ = 1.01663

Year	EP @ CRL	Avg. EP @ CRL	WP @ CRL	Avg. WP @ CRL	Step 1 trend
10	446,608	1117	690,543	1151	1.13787
11	2,368,102	1184	3,322,350	1231	1.07348
12	17,628,912	1259	19,061,813	1271	1.00953
	EP x OLF	/ EE	WP x OLF	/ WE	

$$\frac{\text{12 Avg. WP @ CRL}}{\text{Year's Avg. EP @ CRL}}$$

Step 2 trend
7/1/12 trend from 1/1/15 trend to (2.5 years trend)

Earned prem
Year 10: 446,608 x 1.13787 x $1.02^{2.5}$ = 533,973
Year 11: 2,368,102 x 1.07348 x $1.02^{2.5}$ = 2,671,129
Year 12: 17,628,912 x 1.00953 x $1.02^{2.5}$ = 18,700,153
21,905,255

Loss
Dev – Use all years weighted avg. for CDFS

	12-24	24-36	36-48
	1.78254 x	1.08479 x	1.02532
To ult	1.98264	1.11225	1.02532

Loss trend: avg. date of loss in hist. period → avg. date of loss in prospective period
7/1/XX → 7/1/15 (same as prem avg. earned date)

Loss
Year 10: 624,486 x 1.02532 x 1.04^5 x 1.12 = 872503
Year 11: 1,316,239 x 1.11225 x 1.04^4 x 1.12 = 1918176
Year 12: 970,667 x 1.98264 x 1.04^3 x 1.12 = 24,245,550
27,036,229

Loss ratio = 27,036,229 / 21,905,225 = 1.23424

Indication = (1.23424 + .07) / (1 - .21 - .08) - 1 = 83.695%

Exam 5 – Question #4 Part A (example 3)

CY	Earned exp.	Latest Avg. WP @ CRL	Trend factor ($1.02^{2.5}$)	EP @ CRL
2010	400 x	1270.78 x	1.0508 =	534,110
2011	2000	1270.78	"	2,670,550
2012	1400	1270.78	"	18,693,854
				21,898,514

$\frac{18750000}{15000} \times \frac{1.07}{1.0525} = 1270.78$

trend period = 7/1/2012-1/1/15
= 2.5 years

1.0(.25) + 1.07(.75) = 1.0525

AY	State x Losses	CDF ult.	Loss trend	Ult. Loss and ALAE
2010	624,486 x	1.016 x	1.04^5 =	771,939
2011	1,316,239	1.089	1.04^4	1,676,857
2012	9,706,667	1.195	1.04^3	13,047,823
				15,496,619

2010 trend period = 7/1/2010 – 7/1/2015

Countrywide LDFs

	12-24	24-36	36-48
Selected	1.097	1.072	1.016

$\frac{83.3+ 87 +78.8}{75 + 80.5 +71.6}$

ULAE

$\frac{15496619 \times 1.12}{21898514} = 0.7926$

Indicated Rate Level change = $\frac{0.7926 + 0.07}{1 - .21 - .08}$ -1 = 21.5%

Exam 5 – Question #4 Part B

B. Use extension if exp. to rewrite each policy @ current rate levels/variables
   - Use parallelogram method on accident quarters, finer detail can better reflect changing exposures.

   Or

B. Use extension of exposures to accurately rate all policies at the current rate level.
   Use time periods of experience smaller than 1 year to allow for the growth in exposures and shift in avg. earning date/accident date.

   Or

B. The most accurate method for on-leveling premium would be the extension of exposures method. This technique requires very granular data and involves re-pricing each policy to the current rate level. A second alternative would be to break the premium data down into quarterly or monthly data. This would make for a more accurate on-leveling of a growing book of business.

Exam 5 – Question# 4 Part C

C. Assuming prem is even; avg factors would be too low since more accurate exp. is shifted @ year end as business grows.
   - Adj factor is too high → prem overstated → LR too low → rate need understated

C. Assuming that premium earns evenly assumes that less of the premium has received the benefit of the rate changes. Thus, it results in on-level premium that is too high, and the resulting indication is too low. If actual earning is used, more prem has received the rate changes, so OLFs would be lower, projected prem would be lower, and the indication would be higher.

4.

a. Most candidates correctly calculated the current rate level factors. Candidates did struggle with the premium trend, with common mistakes of missing the trend period or applying to written premium. Most candidates did well with the loss component, receiving full credit on the loss development and loss trend portion of the question. Candidates could get full credit for using either state specific development factors or countrywide as long as the selections were reasonable.

b. Candidates were often able to identify alternatives like extension of exposure or using more refined time periods, but some did lose points for lack of description.

c. Most candidates received partial credit. Candidates were often able to identify the impact on the indication given a premium change, but lacked the discussion leading up to the reason behind the premium change. Credit was also given for a complete discussion of the impact of changing trend periods due to different average earned and average accident dates.

5.

Many candidates skipped this question or received little partial credit with very few receiving full credit.

a. Candidates most often determined the appropriate trend period of 1.5 years. Candidates received credit for knowing the components of the loss ratio trend. Candidates did receive credit whether they treated the loss development factors given in the problem as either cumulative or incremental factors. Candidates struggled with the large loss factor. Many did not calculate it correctly and others did not apply it correctly. An example of incorrect application was not subtracting excess losses from reported losses in 2012 before applying the excess loss factor.

b. Candidates needed to identify the volatility in the data and the benefit of stability in the indications. Multiple responses were acceptable for each piece, but candidates often were able to elaborate on only one component.

c. Candidates often were able to identify 3 different enhancements, receiving full credit.

6.

Candidates did very well on this question. Most candidates successfully applied the Berquist-Sherman case outstanding adjustment technique and set up the steps for calculating the projected ultimate loss and LAE pure premium of the rate level indication. When candidates did lose points it was usually for: not trending the losses and LAE to the effective period, using an incorrect trend period, or not applying the ULAE provision.