

PAST CAS QUESTIONS
EXPERIENCE RATING - EQUITY AND PREDICTIVE ACCURACY

Questions from the 1991 Exam:

9. (1 point) According to Venter in "Experience Rating--Equity and Predictive Accuracy," which of the following statements are true?
1. Given two experience rating formulas, the better functioning experience rating formula will have a larger dispersion among the manual loss ratios of risks with low modifications and high modifications.
 2. Predictive accuracy is enhanced with the use of a single split between primary and excess losses, rather than a multiple split.
 3. With the prior experience rating plan, companies preferred to write large insureds with experience credits.
- A. 1 only B. 2 only C. 3 only D. 1 and 3 E. 2 and 3.
10. (1 point) According to Venter in "Experience Rating--Equity and Predictive Accuracy," which of the following statements are true?
1. Large insureds display more variation in loss ratio than would be predicted by the Law of Large Numbers.
 2. Excess losses are more predictable than total losses.
 3. Current theory and data suggest Z_p and Z_e should decrease as risk size increases.
- A. 1 only B. 2 only C. 1 and 2 D. 1 and 3 E. 2 and 3
48. (2 points)
- a. According to Venter in "Experience Rating--Equity and Predictive Accuracy, " the B and W values in the 1984 National Council on Compensation Insurance Experience Rating Plan were originally designed with two goals in mind. What were they?
 - b. Venter evaluates the new experience rating plan for its ability to satisfy two "general reasoning" tests. What are these?
55. (1 point) What reason does Venter give in "Equity and Predictive Accuracy" for stating that both primary and excess losses are less heavily tailed than total losses?

Solutions to questions from the 1991 Exam:

Question 9.

1. T. Insureds with lower modifications should have better experience in the next period to which the mod applies on a manual premium loss ratio basis and the higher mods should have higher loss ratios. **Thus, the greater the dispersion of the subsequent period manual loss ratios, the better the plan works.** See page 8.
2. F. Predictive accuracy measures the difference between predicted and actual losses, and the expected squared error is the preferred method for determining what is most accurate. See page 3.
3. F. Large insureds had been given too much credit for good experience, **leading to less profit potential than for the debit modified firms**; because too much credibility was given to large insureds in order to achieve self-rating. See page 6. **Answer A.**

Question 10.

1. T. Recent advances in the theory of risk have produced models which show that larger insureds display more variation than the law of large numbers would predict, because all firms are subject to variations due to changing conditions, and this does not decrease by size of firm. See page 6.
2. T. For excess losses, the elimination of the 1st smaller portion of the ground up loss:
 - a. **Increases the average value** of the loss.
 - b. **Reduces the probability of a loss being a large multiple of the average value.**
This makes excess losses **less heavy tailed and more predictable** than total losses. See page 5.
3. F. Current theory and data suggest that **B & K** should vary by size of insured and should **increase** for larger firms. See page 6. **Answer C.**

Question 48.

- (a) The B and W values were designed with two goals in mind:
 1. To prevent too large a swing for small insureds.
 2. To provide self-rating (100% credibility) for the largest firms. See page 6.
- (b) Two tests of plan performance were developed.
 1. The ability of the plan to identify risk differences was tested.
 2. How well the plan corrects for the differences it identifies. See page 7.

Question 55.

Venter states that although this may seem obvious for primary losses, it may not for excess losses.

For excess losses, the elimination of the 1st smaller portion of the ground up loss:

1. **Increases the average value** of the loss.
2. **Reduces the probability of a loss being a large multiple of the average value.**

This makes excess losses less heavy tailed and more predictable than total losses. See page 5.

Questions from the 1992 Exam:

15. (1 point) According to Venter in Experience Rating - Equity and Predictive Accuracy, Which of the following are true?
1. Excess losses are more predictable than total losses.
 2. The theory that B and K should be constants assumes that larger insureds are more stable than small insureds.
 3. Safety incentive is one of the primary goals of experience rating.
- A. 3 only B. 1 and 2 C. 1 and 3 D. 2 and 3 E. All of the Above
16. (1 point) According to Venter in Experience Rating - Equity and Predictive Accuracy, which of the following are true?
1. Excess losses are less heavy-tailed than total losses.
 2. The greater the dispersion of the subsequent period loss ratios based on standard premium, the better an experience rating plan works.
 3. Data and current theory suggest that B and K should decrease for larger insureds.
- A. 1 only B. 2 only C. 1 and 3 D. 2 and 3 E. All of the Above
47. (2 Points) According to Venter in Experience Rating - Equity and Predictive Accuracy, the conditional expected value is under certain conditions the most accurate estimator. However, it is generally impractical to use.
- a. What requirement is imposed on the most common estimation approach used in experience rating?
 - b. What desirable property does this approach retain?
 - c. How was the workers compensation experience rating formula adjusted to ameliorate the effect of the requirement discussed in 'a.' ?
 - d. Why was the adjustment in 'c.' deemed a practical necessity?

Solutions to questions from the 1992 Exam:

Question 15.

1. T. For excess losses, the elimination of the 1st smaller portion of the ground up loss:
1. **Increases the average value** of the loss.
 2. **Reduces the probability of a loss being a large multiple of the average value.**

This makes excess losses **less heavy tailed** and more predictable than total losses. See page 5.

2. T. The theory that B and K should be constants assumes that:
- a) Larger insureds are more stable than smaller insureds and
 - b) Increased stability follows a mathematical form related to the law of large numbers.
 - c) Variance of the Formula 5 loss ratio is inversely proportional to the firm's premium. See page 5.
3. T. Two primary goals of experience-rating are:
1. Safety incentive.
 2. Predictive accuracy. See page 1.

Answer E.

Question 16.

1. T. For excess losses, the elimination of the 1st smaller portion of the ground up loss:
1. **Increases the average value** of the loss.
 2. **Reduces the probability of a loss being a large multiple of the average value.**
- This makes excess losses less heavy tailed and more predictable than total losses. See page 5.
2. F. Insureds with lower modifications should have better experience in the next period to which the mod applies on a manual premium loss ratio basis and the higher mods should have higher loss ratios.
Thus, the greater the dispersion of the subsequent period manual loss ratios, the better the plan works. page 7.
3. F. B and K should vary by size of insured and should **increase for larger firms**. See page 6.

Answer A.

Question 47.

- (a). The most commonly used approach to experience rating requires the **modification** to be a linear function of the losses. page 3.
- (b). When the mod is a linear function of the losses, $M = \frac{(A+K)}{(E+K)}$, which minimizes the expected squared error, if K is chosen correctly. See page 3.
- (c). Since 1940, the multi-split formula has been used in WC. In a multi-split formula, both actual and expected losses are divided into primary and expected losses. See page 4.
- (d). The shift to a multi-split plan was based on difficulties with the then existing formula.
The **difference** between the unconstrained optimal estimate (the conditional expected value) and the best linear estimator is small or zero for some distributions but **substantial for highly skewed distributions (typically found for WC loss ratios)**. See page 4.

Questions from the 1993 Exam:

19. (1 point) According to Venter in Experience Rating -- Equity and Predictive Accuracy, which of the following statements are true?

1. Two goals of experience rating are safety incentive and predictive accuracy.
2. The experience rating plan parameters B and K should vary with the size of the insured.
3. For a multi-split experience rating plan, the experience rating mod is calculated by minimizing the conditional expected value of primary and excess loss separately.

A. 1 only B. 3 only C. 1 and 2 D. 2 and 3 E. 1, 2 and 3

49. In the table below, all experience rated risks are separated into quintiles by modification factor, and then they are further separated into large and small risks. The standard loss ratio is presented for each grouping.

Quintile of Modification Factor	Standard Loss Ratio	
	Small Risks	Large Risks
First (Lowest)	1.08	.95
Second	1.05	.98
Third	1.01	1.01
Fourth	.98	1.02
Fifth (Highest)	.96	1.03

- a. (1 Point) What is indicated about the plan's credibility by the above table? Discuss your answer.
- b. (1 Point) If your underwriters wanted an indication as to the kinds of risks to write, what would you tell them based on the data shown in the above table?

Questions from the 1994 Exam:

20. (1 point) According to Venter, in "Experience Rating - Equity and Predictive Accuracy", which of the following statements are true?

1. The single-split form of the revised NCCI Workers' Compensation Plan is intended to increase the plan's predictive accuracy.
2. Under the prior plan, companies could receive a profit greater than intended by writing large insureds with credit modifications.
3. For workers' compensation, excess losses are more predictable than total losses.

A. 1 and 2 B. 1 and 3 C. 2 and 3 D. 1, 2, and 3 E. None of A, B, C, D

Solutions to the questions from the 1993 Exam:

Question 19.

1. T. Two primary goals of experience-rating are:
 1. Safety incentive.
 2. Predictive accuracy. See page 1.
2. T. B and K should vary by size of insured and should **increase** for larger firms. See page 6.
3. F. The experience modification can be calculated by minimizing the **squared error** of the primary and excess losses separately. See page 4. **Answer C.**

Solutions to the questions from the 1993 Exam:

Question 49.

- (a) Ideally, the closer the standard loss ratios to unity, the better.

For small risks, a downward standard loss ratio trend from credit risks to debit risks, is shown. This suggests that **credibility is overstated**. The worst experience is generated by credit risks.

By decreasing credibility, *smaller credits will be given to those with the lowest mods*, which **increases** standard premium, and decreases the standard loss ratio.

By decreasing credibility, *smaller debits will be given to those with the highest mods*, which **decreases** standard premium, and increases the standard loss ratio.

This will cause standard loss ratios for all risks to draw closer to unity.

The exact opposite is true for large risks. Thus credibility is understated for larger risks.
- (b) Write those risks producing the smallest standard loss ratios: small debit risks or large credit risks.

Solutions to the questions from the 1994 Exam:

Question 20.

1. F. The reason for the split was to simplify the operation of the plan. See page 7.
2. F. In terms of the weight given to individual experience, as opposed to the manual rates: *Too much weight was given to large insureds and Too little given to small insureds*. The result: **Small insureds** with credit modifications came to be regarded as preferred business. See page 6.
3. T. For excess losses, the elimination of the 1st smaller portion of the ground up loss:
 1. **Increases the average value** of the loss.
 2. **Reduces the probability of a loss being a large multiple of the average value**.

This makes excess losses less heavy tailed and more predictable than total losses. See page 5.

Answer E.

Questions from the 1995 Exam:

18. According to Venter's "Experience Rating -- Equity and Predictive Accuracy," which of the following are true?
1. From the viewpoint of the insurer, after experience rating, all insureds have the same expected profit potential.
 2. Experience rating is an important step in satisfying the statutory requirement that rates are not unfairly discriminatory.
 3. Larger insureds display more variation in losses than the law of large numbers would predict.
- A. 1 only B. 2 only C. 1 and 3 D. 2 and 3 E. 1, 2, and 3.
19. According to Venter's "Experience Rating -- Equity and Predictive Accuracy," which of the following are true?
1. The primary goal of experience rating is individual risk equity.
 2. The expected squared error is the universally preferred method for measuring predictive accuracy.
 3. Excess losses are more predictable than total losses.
- A. 1 only B. 2 only C. 1 and 3 D. 2 and 3 E. 1,2, and 3
42. (3 points) Venter's "Experience Rating -- Equity and Predictive Accuracy" describes two tests of the performance of an experience rating plan. Segregate the data below into debit risks and credit risks, and apply these two tests to evaluate whether experience rating plan A or plan B performs better.

Show all works

Risk	Manual Premium	Experience Modification Plan A	Experience Modification Plan B	Actual Losses
Alpha Me First	100,000	0.75	0.80	60,000
Beta Life Parachutes	100,000	1.15	1.10	70,000
Delta Dawn Songs	100,000	1.05	0.95	100,000
Mu River Traders	100,000	0.85	0.90	110,000
Rho Your Boat Store	100,000	0.95	1.05	110,000
Pi in Your Face	100,000	1.25	1.20	150,000

Solutions to questions from the 1995 Exam:

Question 18.

1. **T.** When experience rating is used, each insured is charged according to his/her identifiable loss potential. See page 2.
2. **T.** See page 2.
3. **T.** This is true, since all insureds are subject to variations due to changing conditions, and this does not decrease by size of firm. See page 6. **Answer E.**

Question 19.

1. **F.** Venter states that there are two primary goals in Experience Rating:
 - i. Safety incentive.
 - ii Predictive accuracy See page 2.
2. **T.** See Page 3.
3. **T.** For excess losses, the elimination of the 1st smaller portion of the ground up loss:
 1. **Increases the average value** of the loss.
 2. **Reduces the probability of a loss being a large multiple of the average value.**

This makes excess losses less heavy tailed and more predictable than total losses. See page 5.

Answer D.

Question 42.

Plan A		
<u>Debit risks:</u> Beta, Delta, Pi	<u>Manual Loss Ratios</u> $\frac{70 + 100 + 150}{300} = 1.067$	<u>Standard Loss Ratios</u> $\frac{70 + 100 + 150}{100 * (1.15 + 1.05 + 1.25)} = .927$
<u>Credit risks:</u> Alpha, Mu, Rho	$\frac{60 + 110 + 110}{300} = .9333$	$\frac{60 + 110 + 110}{100 * (.75 + .85 + .95)} = 1.09$
Plan B		
<u>Debit risks:</u> Beta, Rho, Pi	<u>Manual Loss Ratios</u> $\frac{70 + 110 + 150}{300} = 1.10$	<u>Standard Loss Ratios</u> $\frac{70 + 110 + 150}{100 * (1.1 + 1.05 + 1.2)} = .985$
<u>Credit risks:</u> Alpha, Delta, Mui	$\frac{60 + 100 + 110}{300} = .90$	$\frac{60 + 100 + 110}{100 * (.80 + .95 + .90)} = 1.018$

Plan B performs better. According to Venter:

1. The greater the dispersion of the subsequent period manual loss ratios, the better the plan.
2. The closer to unity of the subsequent period standard loss ratios, the better the plan.

Questions from the 1996 Exam:

4. According to Venter's "Experience Rating—Equity and Predictive Accuracy," which of the following are true ?
1. Standard loss ratios that increase as the size of the experience modification increases indicate that credibility is too low.
 2. Manual loss ratios that decrease as the size of the experience modification increases indicate that credibility is too high.
 3. All risks should be equally desirable after experience rating.
- A. 1,2 B. 1,3 C. 2,3 D. 1,2,3 E. None of 1, 2, 3 are true.
27. (2 points) Using both the goals of experience rating as described in Venter's "Experience Rating - Equity and Predictive Accuracy," and the objectives of schedule rating as described in the National Council on Compensation Insurance's *Experience Rating Plan*, critique the following summary of a plan:
- The plan uses the past three years of experience in calculating an experience credit or debit.
 - For each historical experience year in which losses are more than 20% above the expected amount, there will be a premium surcharge of $\frac{1}{3} \times [\text{actual losses} - (1.20 \times \text{expected losses})]$ for the policy being rated.
 - For those historical years in which loss experience is better than 1.20 times the expected ultimate losses, trend those years' results to the exposure and cost level of the policy being written, average those results, load in current expense and profit provisions, and credibility weight this projection with the manual premium calculated for the proposed policy period.
 - The plan does not offer schedule credits/debits but instead relies on the loss histories as the fundamental basis for a modification.

Questions from the 1996 Exam:

28. Answer the following questions based on Venter's "Experience Rating -- Equity and Predictive Accuracy" and Gillam's "Workers' Compensation Experience Rating: What Every Actuary Should Know":
- a. (0.5 point) According to Gillam, state the primary goal of experience rating.
 - b. (0.5 point) Venter lists two primary goals of experience rating. Which of those two goals is used to achieve Gillam's primary goal ?
 - c. (1.5 points) Price M. High Insurance Company is offering two books of business for sale: Lowballs and Highballs. Your company wants to increase its market share, and currently uses the same experience rating plan as Price M. High. Based on the following data, explain if the current experience rating plan is meeting Gillam's primary goal in (a). **Show all work**
- Assume: All policies have 1/1/95 effective dates.
 Data is developed and trended to a common date.
 All policies are written in one class code with a manual loss ratio of 60%.
- The experience rating plan has an off-balance of unity, both on an overall basis and for policies written in this particular class.

	<u>Lowballs</u>	<u>Highballs</u>
1995 Manual Premium	\$750,000	\$500,000
1995 Losses	\$432,000	\$308,000
1995 Experience Modification Factor	0.90	1.10

- d. (0.5 point) Your company has set aside enough capital to purchase one of the above books of business. Based on the above data, which book of business is more preferable, and why?

Solutions to questions from the 1996 Exam:

Question 4

1. T. This is best answered by reference to Gillam’s paper, "Workers' Compensation Experience Rating: What Every Actuary Should Know", See page 219. Gillam states that “ a trend upward...in the loss ratios to actual (standard) premium across risks grouped by increasing value of the mod would show too little ...credibility.
2. F. Again, this is best answered by reference to Gillam’s paper, "Workers' Compensation Experience Rating: What Every Actuary Should Know", See page 227. Gillam states that “need rate level changes are based on standard premium”. **By increasing credibility, larger credits will be given to those with the lowest mods**, which **decrease** standard premium, and increases manual premium.

In this case, Manual premium = Standard premium ÷ (credit) mod.

As Venter states, the greater the dispersion of the subsequent period manual loss ratios, the better the plan. Page 7. The same logic holds true for *larger debits given to those with the highest mods*.

3. T. “..after experience rating, all insureds have the same expected profit potential”. See page 2. **Answer B.**

Solutions to questions from the 1996 Exam:

Question 27.

1. Without schedule rating, there is no way to reflect characteristics of the risk (i.e. safety devices, training, etc.) that are not reflected in its experience.
2. This weakens the overall objectives of an Experience rating and Schedule rating plan in promoting an incentive for safety and maximization of predictive accuracy.
3. The latest year’s experience is not mature enough to warrant its inclusion in the Experience Rating calculation.
4. Large insureds should have more stable results than small insureds. Small insureds would then be more susceptible to the premium surcharge amount. This may be improper, since a smaller insured’s experience is more likely to be susceptible to a random fluctuation in loss experience.

Solutions to questions from the 1996 Exam:

Question 28.

- a. The **primary goal** of experience rating is **individual risk equity**.
- b. Predictive Accuracy.
- c.

	<u>Lowballs</u>	<u>Highballs</u>
Manual Loss Ratios	$\frac{432,000}{750,000} = .576$	$\frac{308,000}{500,000} = .616$
Standard Loss Ratios	$\frac{432,000}{750,000 * .9} = .640$	$\frac{308,000}{500,000 * 1.1} = .56$

According to Venter:

1. The greater the dispersion of the subsequent period manual loss ratios, the better the plan.
2. The closer to unity of the subsequent period standard loss ratios, the better the plan.

The manual loss ratios for Lowballs and highballs appear to appropriate on a relative basis.

The standard loss ratios are very different, and not close to unity.

This plan’s mods do not seem to satisfy Gillam’s primary goal of individual risk equity, since a lower standard loss ratio is produced for a more risky group (highballs).

- d. Highballs produces a lower standard loss ratio than Lowballs, and thus a higher profit.

Questions from the 1997 Exam:

6. In an economic environment in which all insureds are subject to variations due to changing conditions, the International Council on Compensation Insurance decides to implement an experience rating plan that utilizes constant B and K values over all ranges of expected losses. According to Venter's "Experience Rating - Equity and Predictive Accuracy," what assumption underlies this rating plan?
- A. Large insureds areas stable as small insureds.
 - B. Large insureds are more stable than small insureds.
 - C. Large insureds are less stable than small insureds.
 - D. Both large and small insureds are not stable.
 - E. None of the above, because B and K cannot both be constant in a valid experience rating plan.
7. According to Venter's "Experience Rating - Equity and Predictive Accuracy," which of the following statements are true when comparing the proposed Workers Compensation experience rating plan to the then current experience rating plan?
- 1. Standard loss ratios for large risks with the highest mods are lower under the proposed plan.
 - 2. Standard loss ratios for small risks with the highest mods are lower under the proposed plan.
 - 3. Standard loss ratios for medium risks with the lowest mods are lower under the proposed plan.
- A. 2 B. 3 C. 1, 2 D. 1, 3 E. 2, 3
- 29.
- a. (1 point) According to Venter's "Experience Rating - Equity and Predictive Accuracy," what are the two goals of B and W for the Workers Compensation Experience Rating Plan?
 - b. (1 point) What change in credibility due to the revised 1991 Experience Rating Plan as outlined in Gillam and Snader's "Fundamentals of Individual Risk Rating" specifically prevents one of those goals from being achieved?

Solutions to questions from the 1997 Exam:

Question 6

On page 5, Venter states the following:

- The **theory** that *B and K should be constants* assumes that:
 - a) Larger insureds are more stable than smaller insureds and
 - b) Increased stability follows a mathematical form related to the law of large numbers.
 - c) Variance of the Formula 5 loss ratio is inversely proportional to the firm's premium.
- **In practice**, however, B and K should vary by size of insured and should increase for larger firms.

Answer B.

Question 7

On page 8, Venter states the following when comparing the current to the proposed plan :

".. the closer to unity, the better, and the proposed plan seems to work better,"

1. **F.** Although one might tend to think this is true, Venter states (page 9) that for the largest firms, the current plan is over responsive. Not only are the credits too high for those with the lowest mods, but *the debits are too high as well, for the two highest modification groups*. To correct this, standard loss ratios for large risks with the highest mods were **raised** under the proposed plan.
2. **T.** See page 8.
3. **F.** For the medium risks, the standard loss ratios for the lowest and highest modification groups are closer to unity. See page 9.

Answer A.

Question 29.

- a. The B and W values **were** designed with two goals in mind:
 1. To prevent too large a swing for small insureds.
 2. To provide self-rating (100% credibility) for the largest firms. See page 6.
- b. The second goal was never achieved.
For large risks, primary credibility is much smaller. The maximum primary credibility is 91%, rather than 100% . Therefore, there is no more self-rating. See page 13.

Questions from the 1998 Exam:

19. According to Venter's "Experience Rating -- Equity and Predictive Accuracy," which of the following are true?
1. The incentive value of experience rating has a direct effect on the actuarial equity of the plan.
 2. Minimal dispersion of subsequent period manual loss ratios is a characteristic of an effective experience rating plan.
 3. Expected squared error is the preferred method of measuring accuracy both because it leads to solvable equations and because it mitigates against large individual errors.
- A. 1 B. 3 C. 1, 2 D. 2, 3 E. 1, 2, 3
40. Venter's "Experience Rating - Equity and Predictive Accuracy" discusses the use of conditional expected values in experience rating.
- a. (0.5 point) Describe the conditional expected value approach in this context.
 - b. (0.75 point) What are the three reasons that Venter gives to explain why the conditional expected value approach is not used in experience rating?
 - c. (0.5 point) According to Venter, what assumption underlies the most commonly used alternative to the conditional expected value method?
 - d. (0.75 point) According to Venter, what problem led to the introduction of split experience rating plans?

Questions from the 1999 Exam:

15. According to Venter's "Experience Rating - Equity and Predictive Accuracy," the split plan modification formula is used by the National Council on Compensation Insurance with the following exceptions:
1. B is not a constant but varies by size of risk according to published tables.
 2. Expected primary losses are used in place of expected total losses.
 3. K is not a constant but varies by size of risk according to published tables.
- A. 1 B. 2 C. 1, 2 D. 1, 3 E. 2, 3
- 29.
- a. (1 point) According to Gillam and Snader's "Fundamentals of Individual Risk Rating," what are two changes in credibility in the Revised 1991 Experience Rating Plan that affect small risks?
 - b. (1 point) According to Venter's "Experience Rating - Equity and Predictive Accuracy," what are the two primary goals of experience rating?
 - c. (1 point) Briefly describe how either of the two changes from part a. that affect small risks support one primary goal in part b.

Solutions to questions from the 1998 Exam:

Question 19

1. F. "The incentive value of experience rating cannot be used to define equity". See page 2.
2. F. This is true for standard loss ratios. See pages 7 and 8.
3. T. See page 3.

Answer B.

Question 40.

- a. The conditional expected value approach determines the expected value of next year's loss ratio given several years of observation of an insured's loss ratio. See page 3.
- b. The conditional expected value function is not widely used because:
 1. It requires additional statistical assumptions.
 2. It is sometimes cumbersome to compute.
 3. It is not always readily understood. See page 3.
- c. The most commonly used approach to experience rating requires the modification to be a linear function of the losses. Thus, the formula that minimizes the expected squared error, subject to the linearity constraint, is sought. The formula that does this (under popular, but overly simplified statistical assumptions) is

$$\text{Modification} = \frac{(A+K)}{(E+K)}, \text{ Formula 1.}$$
 See page 3.
- d. In workers compensation, the difference between conditional expected value and the best linear estimate was substantial, due to its highly skewed and heavy-tailed distribution. Page 4.

Solutions to questions from the 1999 Exam:

Question 15

1. T. B (and K) is not a constant but varies by size of risk according to published tables. Page 5.
2. F. Expected total losses are still used, but are split into Expected primary losses and Expected excess losses. $ME = \{[A_p + W*A_e + (1-W)E_e + B] / (E+B)\} * E$. Page 5.
3. T. See the response to statement 1 above. Page 5.

Answer D.

Question 29.

- a. see page 13.
 1. For small risks, primary credibility is larger.
 2. For small risks, excess credibility is a little larger. Even the smallest risks now have non-zero excess credibility, where before they had none.
- b. Venter states that the two primary goals of experience rating are:
 1. Safety incentive.
 2. Predictive accuracy.
- c. Predictive accuracy measures the difference between predicted and actual losses, and increasing excess credibility increases predictive accuracy. It improves plan performance by creating a greater the dispersion among subsequent period manual loss ratios. On a standard premium basis, the loss ratios should be less dispersed and ideally all equal.

Questions from the 2000 Exam:

1. You are considering three separate experience rating plans. The table below shows manual and standard loss ratios for each plan, with risks grouped based on the prior year's experience modification using that plan. Based on Venter's "Experience Rating - Equity and Predictive Accuracy" and the following table, which of the following are true?

Risks Grouped Based on Prior Year Experience Modification	Manual Loss Ratio*			Standard Loss Ratio*		
	Plan 1	Plan 2	Plan 3	Plan 1	Plan 2	Plan 3
Lowest	0.50	0.55	0.60	1.10	0.99	0.90
Below Average	0.75	0.80	0.80	1.08	1.01	0.95
Average	1.00	1.00	1.00	1.00	1.02	1.00
Above Average	1.25	1.20	1.20	0.92	0.98	1.05
Highest	1.50	1.45	1.40	0.90	1.00	1.10

*Loss ratios for current year, indexed to 1.00

1. Plan 1 is the best at identifying underlying risk differences.
 2. Plan 2 is the best at correcting for the risk differences it identifies.
 3. Plan 3 is too responsive to the experience.
- A. 2 B. 3 C. 1, 2 D. 1, 3 E. 1, 2, 3
3. According to Venter's "Experience Rating - Equity and Predictive Accuracy," which of the following are true?
1. Large insureds display more variation in loss ratio than would be predicted by the law of large numbers.
 2. Excess losses are more predictable than total losses.
 3. For a multi-split experience rating plan, the experience modification is calculated by minimizing the conditional expected value of primary and excess losses separately.
- A. 1 B. 3 C. 1,2 D. 2,3 E. 1, 2, 3
43. Use Gillam and Snader's "Fundamentals of Individual Risk Rating" and Venter's "Experience Rating - Equity and Predictive Accuracy" to answer the following.
- a. (1.5 points) For each of the experience rating plans listed below, identify how losses are split into primary and excess components for the purpose of experience rating:
 - i. NCCI's 1991 Experience Rating Plan
 - ii. NCCI's 1961 Experience Rating Plan
 - b. (0.5 point) Briefly describe the reason for the change in the plan.

Solutions to questions from the 2000 Exam:

Question 1.

1. Plan 1 is the best at identifying underlying risk differences. *True. This plan works best among the other proposed plans, based on the greater dispersion of the manual loss ratios.*
2. Plan 2 is the best at correcting for the risk differences it identifies. *True. For standard loss ratios, the closer to unity, the better, and this is especially true for the highest and lowest groups.*
3. Plan 3 is too responsive to the experience. *False. The plan is not responsive enough, as there is still a fair dispersion among the standard loss ratios.*

Answer C.

Question 3.

1. Large insureds display more variation in loss ratio than would be predicted by the law of large numbers. *True. All insureds are subject to variations due to changing conditions and this does not decrease by size of firm. See page 6.*
2. Excess losses are more predictable than total losses. *True. For excess losses, the elimination of the 1st smaller portion of the ground up loss:*
 - c. **Increases the average value** of the loss.
 - d. **Reduces the probability of a loss being a large multiple of the average value.***This makes excess losses **less heavy tailed and more predictable** than total losses. page 5.*
3. For a multi-split experience rating plan, the experience modification is calculated by minimizing the conditional expected value of primary and excess losses separately. *False. the experience modification is calculated by minimizing the conditional expected value of primary and excess losses separately.*
*False. The most commonly used approach to experience rating requires the **modification** to be a linear function of the losses. Thus, **the formula that minimizes the expected squared error, subject to the linearity constraint, is sought.***

The formula that does this (under popular, but overly simplified statistical assumptions) is

$$\text{Modification} = \frac{(A+K)}{(E+K)}, \text{ Formula 1.}$$

A = Actual losses, E = Expected Losses, K = the credibility constant.

Formula 1 minimizes the expected squared error, if K is chosen correctly.

Answer C.

43. Use Gillam and Snader's "Fundamentals of Individual Risk Rating" and Venter's "Experience Rating - Equity and Predictive Accuracy" to answer the following.
 - a. (1.5 points) For each of the experience rating plans listed below, identify how losses are split into primary and excess components for the purpose of experience rating:
 - NCCI's 1991 Experience Rating Plan
 - NCCI's 1961 Experience Rating Plan
 - i. Actual primary losses are limited to \$5,000. Actual excess losses equal actual losses limited to the state accident limit minus actual primary losses.
 - $A_p = 5000$ if $A \geq 5000$ Note: $A_e = A - A_p$ A limited to state accident limit
 - A if $A < 5000$
 - ii. $A_p = (A * 10,000)/(A + 8000)$ if $A \geq 2000$
A if $A < 2000$
 $A_e = A' - A_p$, where A' is A subject to a maximum rating value.
 - b. (0.5 point) Briefly describe the reason for the change in the plan.
The reason for the change was simple. To simplify the operation of the plan.
See Venter, page 7.