12. (3.25 points)

A policy has a flat dollar deductible of M and a maximum payout on a loss by the insurer of N.

a. (1.0 point)

Draw a Lee diagram representing the expected amount of loss incurred by this policy. Label the following:

i. The axes

ii. The deductible amount

iii. The policy limit

iv. The expected insured loss.

b. (0.5 point)

Assume cumulative losses follow a distribution $F(x)$. Write the formula for covered losses for this policy using:

i. The layer method

ii. The size method

c. (0.5 point)

Briefly describe when the layer method may be preferred and when the size method may be preferred.

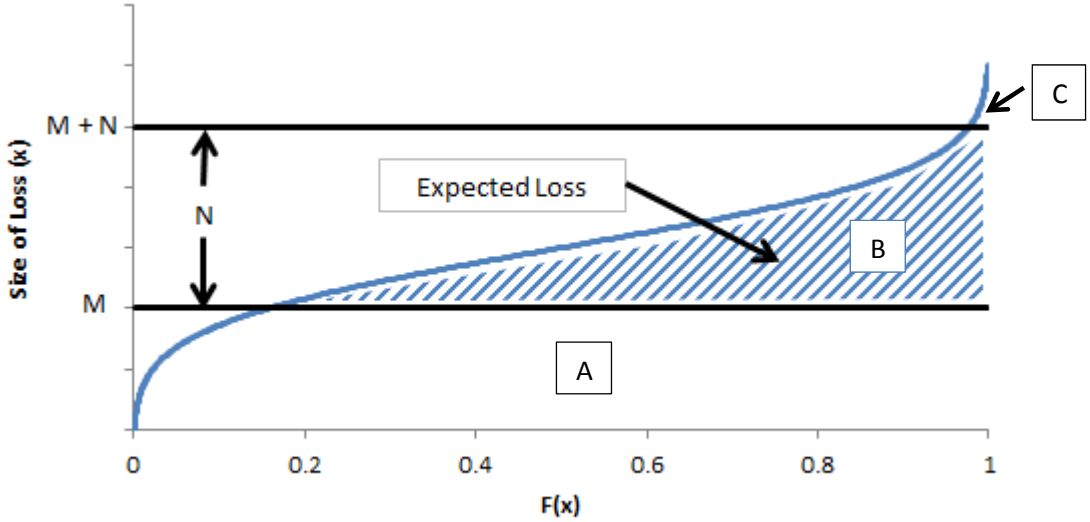
d. (1.25 points)

Use a Lee diagram to demonstrate the consistency test of ILFs.

CONTINUED ON NEXT PAGE

QUESTION 12	
TOTAL POINT VALUE: 3.25	**LEARNING OBJECTIVE(S): B1b, B2b**
SAMPLE ANSWERS	

Part a: 1.0 point



Expected Insured Loss = B

Part b: 0.5 point

Sample 1

i. $\int_M^{M+N} 1 - F(x)dx$

ii. $\int_M^{M+N} xdF(x) + (M+N) * \big(1 - F(M+N)\big) - M * \big(1 - F(M)\big)$

Sample 2

i. $\int_M^{M+N} S(x)dx$

ii. $\int_M^{M+N} (x-m)dF(x) + (N) * S(M+N)$

Part c: 0.5 point

Sample 1

The layer method may be preferred when the survival function is easy to integrate.

The size method may be preferred when empirical data is not available and integrals need to be evaluated algebraically.

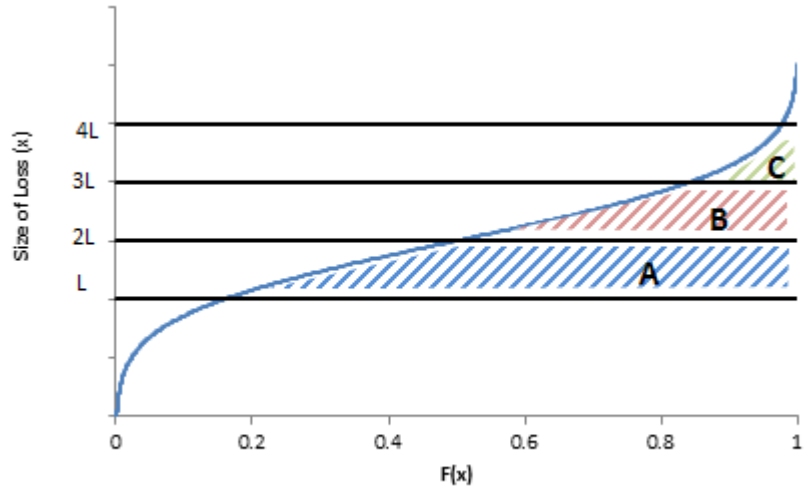
Sample 2

The layer method may be preferred when calculating expected losses at many limits.

The size method may be preferred when calculating expected losses at one limit as it is more intuitive to explain.

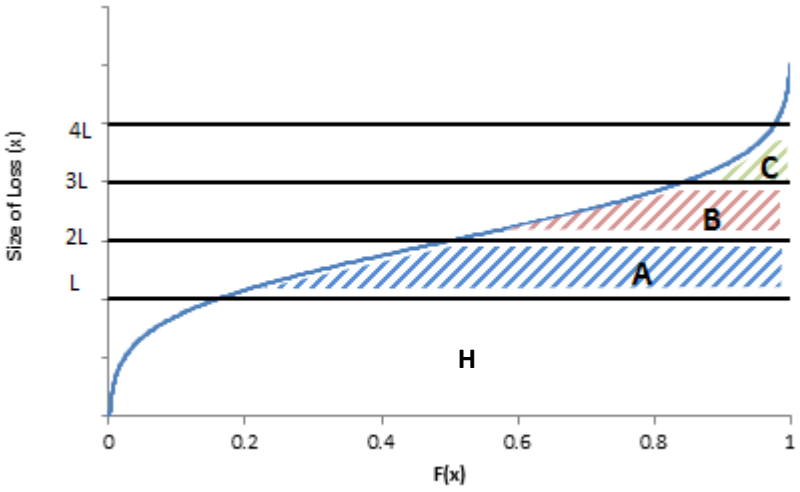
Part d: 1.25 points

Sample 1



The consistency test of ILFs states that the premium calculated from the layer formula applied to successive excess layers of constant width is a decreasing function of the attachment point limit. Area A > Area B > Area C therefore Premium for Layer L to 2L > Premium for Layer 2L to 3L > Premium for Layer 3L to 4L and the consistency test is satisfied.

Sample 2



The consistency test says that ILFs should increase at a decreasing rate.

$$ILF\ (2L) = \frac{A + H}{H}$$

$$ILF\ (3L) = \frac{A + B + H}{H}$$

$$ILF\ (4L) = \frac{A+B+C+H}{H}$$

$$\frac{ILF(3L) - ILF(2L)}{3L-2L} > \frac{ILF(4L) - ILF(3L)}{4L-3L} = \frac{B}{L} > \frac{C}{L}$$

Since are B is greater than area C the ILFs pass the consistency test.

EXAMINER'S REPORT

Candidates were expected to demonstrate knowledge of Lee diagrams for various policy provisions and have an understanding of the size and layer method.

In part (d), candidates were expected to describe the consistency test for ILFs and tie it to a Lee diagram with various limits.

Part a

Most candidates answered part (a) by drawing a Lee diagram for a single loss and labeling the size of loss on the y-axis. Candidates were generally successful in correctly labeling the deductible ***M*** but often did not correctly label ***M+N*** as the policy limit.

The term *insured* was ambiguous and could've been interpreted as meaning losses covered by either the policyholder or the insurance company. Candidates who labeled the expected insured loss as either sections ***A+C*** or ***B*** in the diagram above received full credit.

Some candidates interpreted part (a) as a request for an aggregate Lee diagram for the total losses to the policy. Candidates who interpreted this question as requesting an aggregate Lee diagram were able to receive full credit. The exam syllabus does not give clear examples of aggregate Lee diagrams with the existence of per occurrence deductibles and limits and thus graders accepted a variety of solutions.

Part b

Candidates were expected to provide two equations that would evaluate the amount of covered loss for the policy described in this question. Loss amounts covered under this policy are those above the deductible ***M***, and below the policy limit of ***M+N***. The provided equations were expected to account for these two values. Under the layer method the provided integral should have been evaluated with respect to the size of loss, while under the size method the integral should have been expressed in terms of the distribution function.

Candidates generally provided a correct expression for determining the amount of covered loss under the layer method, but few candidates received full credit in part (b). Common reasons for not receiving full credit included using incorrect bounds or providing an expression that did not evaluate to the amount of covered loss. Note that when candidates used incorrect values of the deductible and policy limit in part (a), they were not penalized for using these values as bounds in the equations provided in part (b).

Part c

Candidates were expected to provide one reason supporting the use of the layer method and an additional reason supporting the use of the size method.

A variety of responses were considered reasonable and candidates often received full credit for part (c).

Part d

Candidates were asked to draw a Lee Diagram to demonstrate the consistency of ILFs. To receive full credit, candidates were expected to draw an appropriately labeled Lee Diagram, provide a brief description of how to validate the consistency of ILFs, and connect these requirements back to the diagram.

In general, candidates performed well on this part, receiving a majority of the available points. Candidates who did not receive full credit often failed to provide an adequate explanation of how the Lee Diagram illustrated the consistency of ILFs.