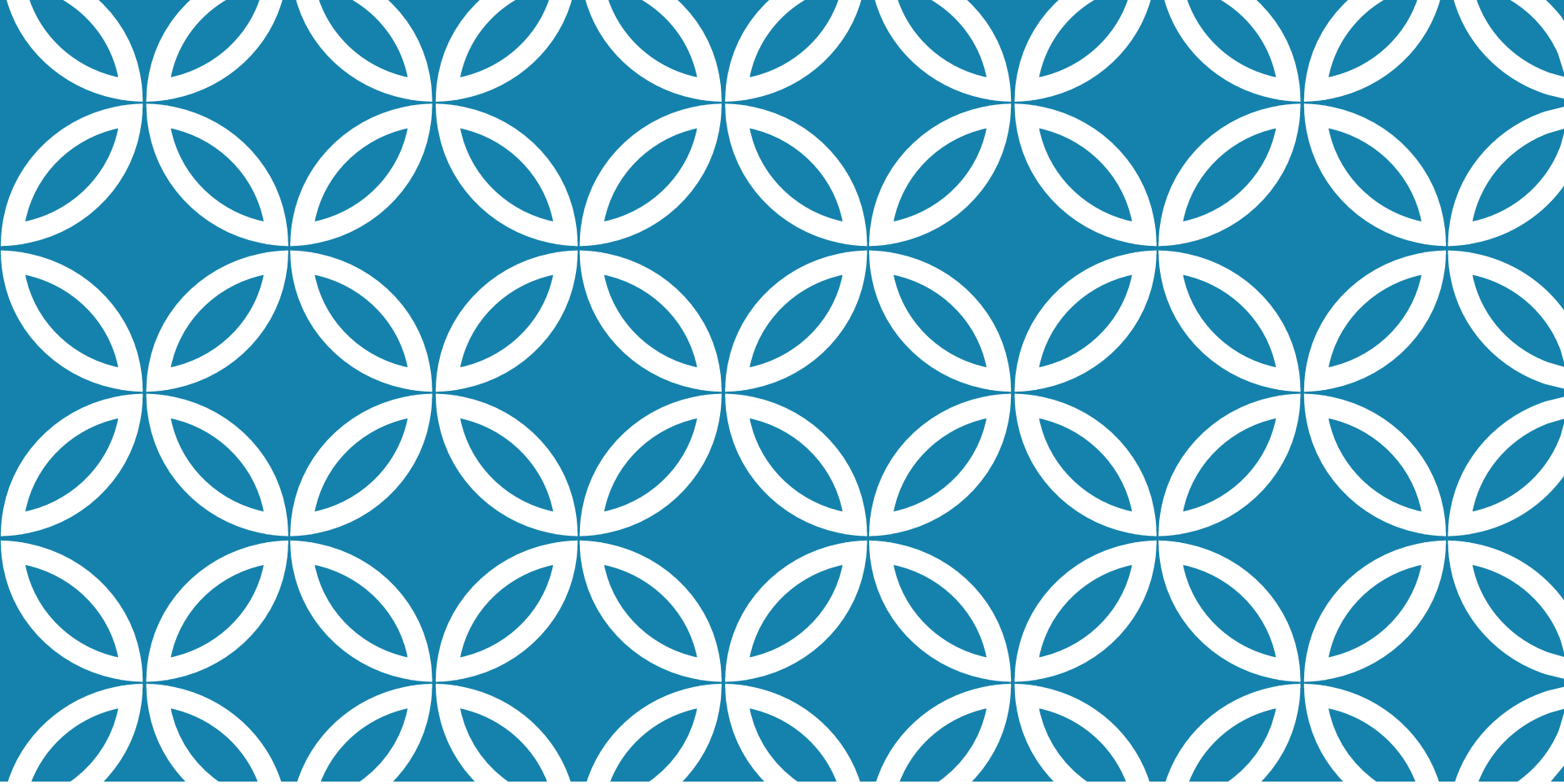

SPREADING THE RISK: HOW INSURANCE WORKS | §7-2

GOALS

Understand how life expectancy tables are used to estimate the probability that an individual will die

Learn how insurance companies determine its premium schedule to make a reasonable profit

STATISTICAL TABLES

EXPECTED DEATHS PER 100,000 ALIVE AT SPECIFIED AGE		
Age	Expected Deaths Within 1 Year	Expected to be Alive in 1 Year
15	63	99,937
16	79	99,921
17	91	99,909
18	99	99,901
19	103	99,897
20	106	99,894
21	110	99,890
22	113	99,887
23	115	99,885
24	117	99,883
25	118	99,882
26	120	99,880
27	123	99,877
28	127	99,873
29	132	99,868
45	315	99,685
46	341	99,659
47	371	99,629
48	405	99,595
49	443	99,557

PROBABILITY OF AN EVENT

$P(E) = m/n$

P (E) = the probability of event E

m = the # of times the event occurs

n = the # of all possible outcomes

Remember, a probability is always between 0 and 1.

HOW TO USE THE TABLE

The probability that a 24 year old person will die in the next 12 months is found by using the formula and data from the table.

$P(E) = m/n$

Where P (E) is the event that a 24 yr old passes away with the year

m = 117 and n = 99,883 +117 or 100,000

So P (E) = 117/100,000 =0.00117 or 0.117%

COMPLEMENT

In probability, if E is an events, then “E does not occur” or “not E” is the complement of E

Another way to write not E is “~E”

Ex. P (~E) is the event that a 24 yr old does not pass away with the year

m = 99,883 and n = 00,000

So P (E) = 99,883/100,000 =0.99883 or 99.883%

COMPLEMENTS

You will notice that $P(E) + P(\sim E) = 1$ or 100%

EXPECTED VALUE

Expected Value is intuitively the long-run average value of repetitions of the experiment it represents.

For Example, in a game where money is awarded for a success, it is the amount of money to be won or lost in the long run.

If the event can assume two values, then the expected value of the events is the sum of the product of each value and its probability.

$$E = P_1 v_1 + P_2 v_2$$

$v_1 \, and \, v_2$ are values and $P_1 and P_2$ are the corresponding probabilities

SKILL 1

Suppose that if you flip a coin and you get a Heads you win $10 and if you get a Tails you get only $1. What is the expected value of the game??

E = .5*($10) + .5($1) =

$5.50

*note…for the privilege of tossing the coin you should pay no more than $5.50

BREAK EVEN VALUE

AKA- Break even point- is the value at which revenue equals expenses.

This is the cost of the premium that gives no profit or loss after paying all expenses.

SKILL 2

The direct and indirect expenses for each policy that the Pacific Life insurance company writes are about $95. Show how Mary use probability to determine the proper premium for a $250,000 policy on a 47 year old dude…

Hints: let x = the value of the premium

Use the table on page 676.

The direct and indirect expenses for each policy that the Pacific Life insurance company writes are about $95. Show how Mary use probability to determine the proper premium for a $250,000 policy on a 47 year old dude…

P (lives) =0.99629 & P(~lives) = 0.00371

$$E = P_1 v_1 + P_2 v_2$$

$95 = 0.99629(x) +0.00371(x-250,000)

95 = 1.00000x - 927.50

1,022.50 = x

The break even premium for one year of insurance for a 47 yr. old is $1,022.50.

SKILL 3

Leah told Lisa and Luke that at All-State they charge a 25 year old $975 for a one year term $750,000 policy. What is the profit on 100,000 policies if the expenses are $38 each.

Let P = total profit

P = 100,000 ($975) -118 deaths($750,000) - 100,000($38)

P = $5,200,000

How much profit for each policy

5,200,000 / 100,000

$52 profit on each policy

SKILL 4

What is the expected number of deaths for 20,000 22 year olds?

Using proportions and the table we can find this easily.

$$\frac{113}{100{,}000} = \frac{d}{20{,}000}$$

Cross multiply…

100,000d = 113(20,000)

d = 22.6

The expected deaths for 20,000 22 year olds is 22.6.

PROFIT ON INSURANCE

The insurance companies must charge more that the break even value if they want to make a profit on each policy. Thus the profit is determined by the formula

$P = R - B - C$

P = Profit

R = Revenue received as premiums

B = death benefits paid out

C = costs or expenses

ASSIGNMENT

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