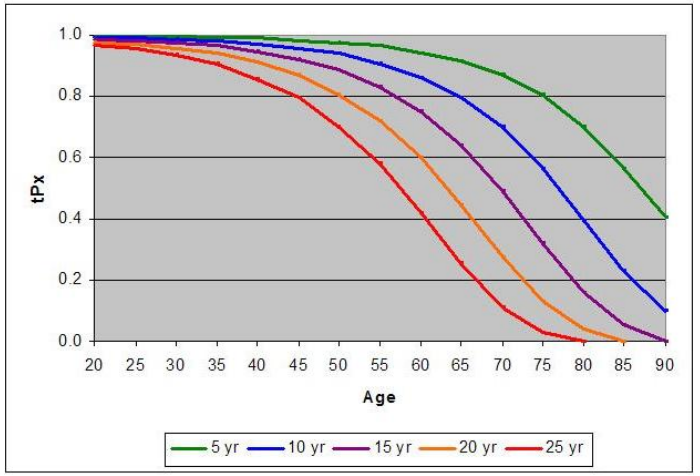
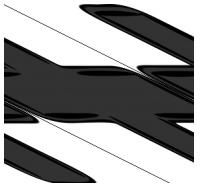
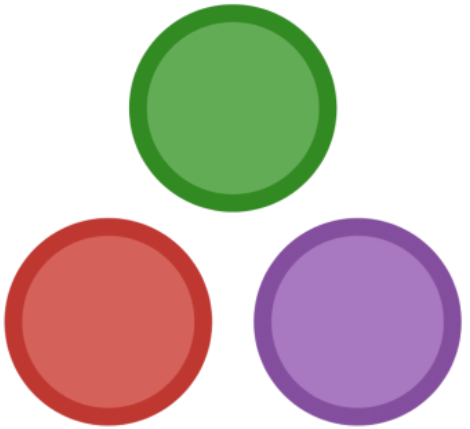
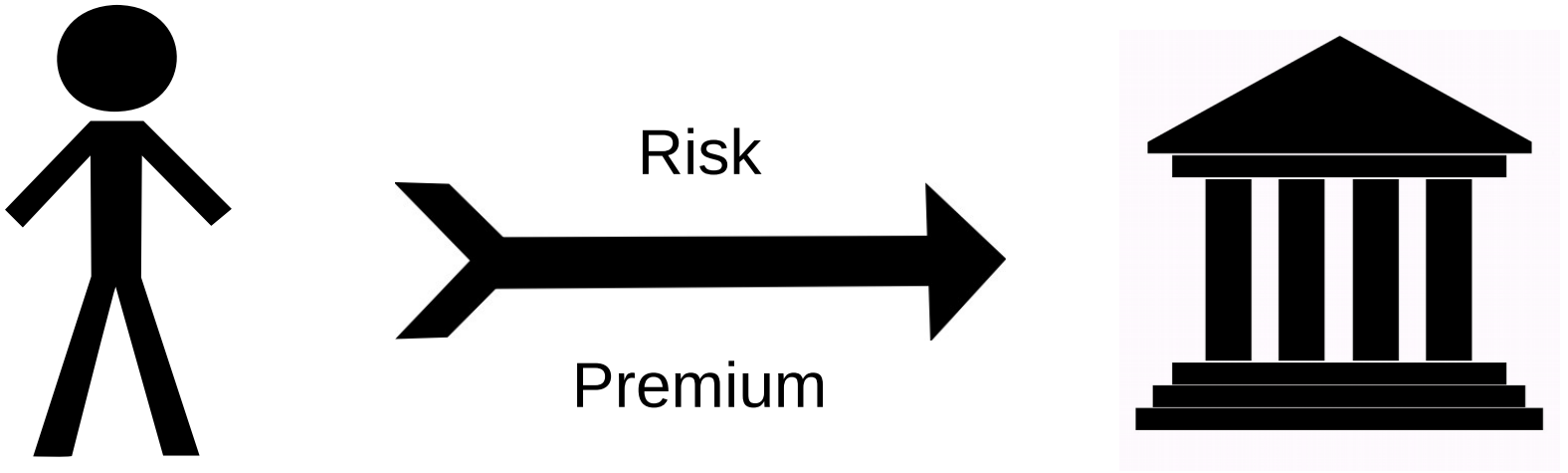
Actuarial Science with Julia







What Is Insurance?



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Section 1: Present Value

1.1 Annuity Immediate

Year	0	1	2	3	4	...	n-1	n
Premium	P							
Claim		C	C	C	C	C	C	C

PV Premiums = P

PV Claims = $C / (1+i)^1 + C / (1+i)^2 + \ldots C / (1+i)^n$

Discount $v = 1 / (1+i)$

1: Present Value

1.2 Annuity Deferred

Year	0	1	2	...	10	11	12	...	n
Premium	P	P	P	P					
Claim						C	C	C	C

|–--------Savings Phase--------| |–--------Income Phase--------|

$$PV\ Premiums = P + P * v^{1} + P * v^{2} + \ldots + P * v^{9}$$

$$PV\ Claims = C * v^{11} + C * v^{12} + \ldots + C * v^{n}$$

1: Present Value

1.3 Term Life Insurance

Year	0	1	2	...	Death			n-1	n
Premium	P	P	P	P	P				
Claim						C			

1.4 Whole Life Insurance

Age	40	41	42	...	Death			99	Maturity
Premium	P	P	P	P	P				
Claim						C			

Section 2: Life Tables

Table 1. Life table for the total population: United States, 2010

Age	Probability of dying between ages x to x+1 q(x)	Number surviving to age x l(x)	Number dying between ages x to x+1 d(x)	Person-years lived between ages x to x+1 L(x)	Total number of person-years lived above age x T(x)	Expectation of life at age x e(x)
0-1	0.006123	100,000	612	99,465	7,866,027	78.7
1-2	0.000428	99,388	43	99,366	7,766,561	78.1
2-3	0.000275	99,345	27	99,331	7,667,195	77.2
3-4	0.000211	99,318	21	99,307	7,567,864	76.2
4-5	0.000158	99,297	16	99,289	7,468,556	75.2
5-6	0.000145	99,281	14	99,274	7,369,267	74.2
94-95	0.206214	11,447	2,361	10,267	39,478	3.4
95-96	0.224274	9,087	2,038	8,068	29,211	3.2
96-97	0.243080	7,049	1,713	6,192	21,144	3.0
97-98	0.262527	5,335	1,401	4,635	14,951	2.8
98-99	0.282492	3,935	1,112	3,379	10,316	2.6
99-100	0.302838	2,823	855	2,396	6,937	2.5
100 and over	1.000000	1,968	1,968	4,542	4,542	2.3