Frequently asked questions:

1. **Explain the term general Insurance**

Ans.

The term general insurance essentially applies to an insurance risk that is not a life insurance or health insurance risk, and so the term covers familiar forms of personal insurance such as motor vehicle insurance, home and contents insurance, and travel insurance. Under such a policy, the insured party pays an amount of money (the premium) to the insurer at the start of the period of insurance cover, which we assume to be one year. There are two sources of uncertainty for the insurer: how many claims will the insured party make, and, if claims are made, what will be the amounts of those claims? Thus, if the insurer were to build a probabilistic model to represent its claims outgo under the policy, the model would require a component that modeled the number of claims and another that modeled the amounts of those claims. This is a general framework that applies to modeling claims outgo under any general insurance policy.

2. **Explain how a motor vehicle insurance policy operates from an insurer's point of view.**

Ans.

Under motor vehicle insurance policy, the insured party pays an amount of money (the premium) to the insurer at the start of the period of insurance cover, which we assume to be one year. The insured party will make a claim under the insurance policy each time, the insured party has an accident during the year that results in damage to the motor vehicle, and hence requires repair costs.

As per the Motor Vehicles Act, 1988 it is mandatory for every owner of a vehicle plying on public roads, to take an insurance policy, to cover the amount, which the owner becomes legally liable to pay as damages to third parties as a result of accidental death, bodily injury or damage to property. A Certificate of Insurance must be carried in the vehicle as a proof of such insurance.

Two types of covers are available:

1. Liability only policy. This covers third party liability for bodily injury liability and / or death and property damage. Personal Accident cover for Owner-driver is also included.
2. Package policy. This cover loss or damage to the vehicle insured in addition to (1) above.

No- claim discounts are available on renewal of policy, ranging from 20% to 50%, depending upon the type of vehicle and the number of years for which no claim has been made.

3. **Explain how one would construct a model if there will be only one claim from the insurer.**

Ans:

Suppose that there will be only one claim if any in the given period. That is, during the period there could be one claim of amount b with probability q and there is no claim with probability 1-q. Then, the claim random variable, X, has a probability function given by

$$f_X(x) = \begin{cases} 1-q & for\ \ x=0 \\ q & for\ \ x=b \\ 0 & elsewhere, \end{cases}$$

with expected value of the claim is E[X]= $b\ q$.

4. **Define the term survival function.**

Ans:

Let X denote the random variable which represents the future lifetime of a newborn. Assume that the distribution function of X is absolutely continuous. The survival function of X, denoted by $s(x)$ is defined by the formula $s(x) = P[X > x] = P[X \geq x]$ where the last equality follows from the continuity assumption.

5. **Define the term force of mortality.**

Ans:

The force of mortality represents the death rate per unit age per unit survivor for those attaining age x. We denote the force of mortality for those attaining age x by μ(x) and symbolically,

$$\mu(x) = \lim_{dx \to 0^+} \frac{1}{dx} \Pr[T(0) \leq x + dx | T(0) > x].$$

In terms of survival function,

$$\mu(x) = \lim_{dx \to 0^+} \frac{1}{dx}\left[1 - \frac{s(x+dx)}{s(x)}\right] = -\frac{s'(x)}{s(x)}.$$

Hence, $\mu(x) = \frac{f_X(x)}{1-F_X(x)}$

Intuitively the force of mortality is the instantaneous 'probability' that someone exactly age x dies at age x.

6. **Write a note on life table**

Ans:

In practice the survival distribution is estimated by compiling mortality data in the form of a life Table. Given a survival model, with survival probabilities ${}_tp_x$, we can construct the **life table** for the model from some initial age x_0 to a maximum age ω. Some of notations used in the Life Tables are

${}_tq_x$ = 1- ${}_tp_x = P[T(x) \leq t] = P[X \leq x + t \mid X > x] = 1 - s(x+t)/s(x)$, ${}_1q_x = q_x$

l_x = number of persons aged x living.

${}_nd_x$ = denotes the number of the group of newborns alive at age x who die before reaching age $x + n$.

d_x = number of persons dying between ages x; x +1, that is $d_x = l_x - l_{x+1} = l_x q_x$.

$l_{x0} = l_0$be an arbitrary positive number called the **radix** of the table.

7. **Consider an example of amount of claim is a random variable. If maximum claim is Rs 2,00,000 which occurs with probability 0.1 and no claim occurs with probability 0.5. Claim amount is positive but less than 2,00,000 with probability 0.4 and the distribution of the claim has the following conditional distribution function:**

$$\boldsymbol{F_1(x) = 1 - \left(1 - \frac{x}{200000}\right)^2 \quad for \quad 0 < x <} \text{ 2,00,000.}$$

Determine the expected claim amount.
Ans.
From the given information, the claim distribution function can be written as

$$F(x) = \begin{cases} 0 & for \quad x < 0 \\ 0.5 + 0.4\left[1 - \left(1 - \frac{x}{200000}\right)^2\right] & for \quad 0 \leq x < 2{,}00{,}000 \\ 1 & for \quad x \geq 2{,}00{,}000. \end{cases}$$

Here, P(X=0) = P(No claim) = $F(0)$ = 0.5 ,

and P(X=2,00,000)=P(Full claim)= F(2,00,000)-F(2,00,000-)=1-0.9 = 0.1,

P(Claim amount is at most 50000) = F(50000) = 0.5+0.4[1-(50000/200000)^2] = 0.875,

P(Claim amount is at least 100000) = 1-F(100000) = 1-{0.5+0.4[1-1/4]}=0.2.

Expected claim amount is

$$E[X] = 0 \times P[X = 0] + 0.4 \times \int_0^{200000} x \, \frac{2}{200000}\left(1 - \frac{x}{200000}\right) dx$$

$$+200000 \times P[X = 200000]$$

Therefore, $E[X] = 0.4 \times 66{,}666.67 + 200000 \times 0.1$ = Rs. 46,666.67

8. **Establish the relation between survival function and force of mortality.**

Ans:
The survival function of X, denoted by $s(x)$ is defined by the formula $s(x) = P[X > \square x] = P[X \geq x]$ and the force of mortality for those attaining age x by μ(x) and define it as

$$\mu(x) = \lim_{dx \to 0^+} \frac{1}{dx}\left[1 - \frac{s(x+dx)}{s(x)}\right] = -\frac{s'(x)}{s(x)}.$$

Therefore, on integrating both sides of this equality gives

$s(x) = exp\{-\int_0^x \mu(t)\, dt\}.$

9. Compute various components of life table for the following data

Age(x)	0	1	2	3	4	5
l_x	100000	97371	97230	97123	97060	96997
Age(x)	6	7	8	9	10	
l_x	96928	96859	96807	96753	96702	

Ans.

The life table is completed using the formula $d_x = l_x - l_{x+1}$ *and* $q_x = d_x / l_x$

Age x	l_x	d_x	q_x
0	100000	2629	0.0263
1	97371	141	0.0014
2	97230	107	0.0011
3	97123	63	0.0006
4	97060	63	0.0006
5	96997	69	0.0007
6	96928	69	0.0007
7	96859	52	0.0005
8	96807	54	0.0006
9	96753	51	0.0005
10	96702	--	--

10. Write a note on Health insurance

Ans.

Health insurance is insurance against the risk of incurring medical expenses among individuals. By estimating the overall risk of health care and health system expenses, among a targeted group, an insurer can develop a routine finance structure, such as a monthly premium or payroll tax, to ensure that money is available to pay for the health care benefits specified in the insurance agreement. The benefit is administered by a central organization such as a government agency, private business or not-for-profit entity. According to the Health Insurance Association of America, health insurance is defined as "coverage that provides for the payments of benefits as a result of sickness or injury. Includes insurance for losses from accident, medical expense, disability, or accidental death and dismemberment".