Definition of Annuity :

A **term** certain **annuity** is an insurance product that guarantees a periodic payment of a predetermined amount for a fixed **term**. Once the **term** has elapsed, these products are spent, and there will be no future payments, even if the annuitant is still alive.

There are four main types of annuities:

- Immediate **annuities**.
- Deferred income **annuities**.
- Fixed **annuities**.
- Variable **annuities**.

Rather than calculating each payment individually and then adding them all up, however, you can use the following formula, which will tell you how much money you'd have in the end:

Two Types of Annuities

Annuities, in this sense of the word, break down into two basic types: ordinary annuities and annuities due.

Ordinary annuities: An ordinary annuity makes (or requires) payments at the end of each period. For example, bonds generally pay interest at the end of every six months.

Annuities due: With an annuity due, by contrast, payments come at the beginning of each period. Rent, which landlords typically require at the beginning of each month, is a common example.

Calculating the Future Value of an Ordinary Annuity

Future value (FV) is a measure of how much a series of regular payments will be worth at some point in the future, given a specified interest rate. So, for example, if you plan to invest a certain amount each month or year, it will tell you how much you'll have accumulated as of

Future value (FV) :

$$FV_{Ordinary\ Annuity} = C \times \left[\frac{(1+i)^n - 1}{i}\right]$$

Where C = Cash flow per period

i = interest rate

n = number of payment

Annuity Payment (PV)

Annuity Payment PV Calculation :

$$P = \frac{r(PV)}{1-(1+r)^{-n}}$$

$P = Payment$
$PV = Present\ Value$
$r = rate\ per\ period$
$n = number\ of\ periods$

Section 3.1 - Annuity Terminology

Definition:

An annuity is intervals of time. Examples: Home Mortgage payments, car loan payments, pension payments. For an annuity - certain, the payments are made for a fixed (finite) period of time, called the term of the annuity. An example is monthly payments on a 30-year home mortgage. For an contingent annuity, the payments are made until some event happens.

An example is monthly pension payments which continue until the person dies. The interval between payments (a month, a quarter, a year) is called the payment period.

Example: The present value of a 5-year annuity with a nominal annual interest rate of 12% and monthly payments of Rs. 100 is:

$$PV\left(\frac{0.12}{12}, 5 \times 12{,}100\right) 100 \times a_{\overline{60}}\, I\, 0.01 = 4{,}495.50$$

Perpetuity

A *perpetuity* is an annuity for which the payments continue forever. Observe that $\lim ¿_{n\to\alpha} PV(i,n,R) = \lim ¿_{n\to\alpha} R \times a\overline{nI}_{i=\lim ¿_{n\to\alpha} R \frac{(1-(1+i)^{-n})}{i} = \frac{R}{i} ¿} ¿¿$

Therefore a perpetuity has a finite present value when there is a non-zero discount rate. The formulae for a perpetuity are

$$a_{\overline{\infty/i}} = \frac{1}{i} \text{ and } \ddot{a}_{\overline{\infty/i}} = \frac{1}{d}$$

$a_{\overline{\infty/i}} = \frac{1}{i}$ and $d = \frac{i}{i+1}$ is the effective discount rate.

Proof of annuity-immediate formula :

To calculate present value, the k-th payment must be discounted to the present by dividing by the interest, compounded by k terms. Hence the contribution of the k-th payment R would be

$\frac{R}{(1+i)^k}$ Just considering R to be one , then

$$a_{¿} i = \sum_{i=1}^{n} \frac{1}{(1+i)^k} = \frac{1}{1+i} \sum_{k=0}^{n-1} \left(\frac{1}{1+i}\right)^k$$

$$= \frac{1}{1+i}\left(\frac{1-(1+i)^{-n}}{1-(1+i)^{-1}}\right)$$

$$= \frac{1-(1+i)^{-n}}{1+i-1}$$

= $1-¿¿$ By using equation for the sum of a geometric series.

A **perpetuity** is a type of **annuity** that lasts forever, into **perpetuity**. The stream of cash flows continues for an infinite amount of time. In finance, a person uses the **perpetuity** calculation in valuation methodologies to find the present value of a company's cash flows when discounted back at a certain rate.

The **difference between an annuity and a perpetuity** is that a **perpetuity** ends after some fixed number **of** payments. ... An **annuity** is a stream **of** N equal cash flows paid at regular intervals. Cash flows from an **annuity** occur every year **in the** future.

An **annuity is** a contract between you and an insurance company in which you make a lump-sum payment or series of payments and, in return, receive regular disbursements, beginning either immediately or at some point in the future.

An **annuity** is a series of payments made at equal intervals. **Examples** of **annuities** are regular deposits to a savings account, monthly home mortgage payments, monthly insurance payments and pension payments. ... The payments (deposits) may be made weekly, monthly, quarterly, yearly, or at any other regular interval of time.

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