



A. M. Ibrahim. B. Arch, MIBC. FIV, FICA, FIE (I), MBIM (U.K).

Life Tables in “Excel” is attached:



The Construction and Application and Use of Life Tables.

Life Estate Valuation:

1.0: Preface: Life Estate is (law) an estate whose duration is limited to the life of the person holding it. A tenant whose legal right to retain possession of buildings or lands lasts as long as they (or some other person) live. Annuity: Income from capital investment paid in a series of regular payments. Annuitant is the recipient of an annuity. (Word web Dictionary).

(Law dictionary): The right to use or occupy real property for one's life. Often this is given to a person (such as a family member) by deed or as a gift under a will with the idea that a younger person would then take the property upon the death of the one who receives the life estate. Title may also return to the person giving or deeding the property or to his/her surviving children or descendants upon the death of the life tenant-this is called "reversion." Example of creation of a life estate: "I grant to my mother, Molly McCree, the right to live in and/or receive rents from said real property, until her death," or "I give my daughter, Sadie Hawkins, said real property, subject to a life estate to my mother, Molly McCree." This means a woman's mother, Molly, gets to live in the house until she dies, then the woman's daughter, Sadie, will own the property. **Source:** <https://dictionary.law.com/Default.aspx?selected=1162>

Life estate is a unique type of partial Interest. In this form of estate, a designated beneficiary, the life tenant, *has* the right to use and occupy a parcel of real estate for *the* duration of his or her life. The life tenant generally enjoys this right without any obligation to pay rent, but typically he or she must maintain the property and pay all applicable liens and taxes The owner of a real property encumbered by a life estate Is called the *remainder man*; he or she enjoys the remaining rights to the property once the life tenant is deceased. Valuation tables in 'Excel' is attached▲: Compounding and Discounting Tables (Tables 1A, 2A, 3A and 5A); Life Tables in 'Excel': table 9: Present Value of an annuity on a single life (Year's Purchase for a single life) and table 10 ► Ascertainment of Insurance Premiums (Single and Annual Premium based on available single life year's purchase).

1.1: Best known Mortality tables of 17th Century are Northampton and Carlisle tables. And US tables can be viewed in [https://www.irs.gov/retirement-](https://www.irs.gov/retirement-actuarial-tables) actuarial tables.

A mortality table is a diagram that shows the death rate for a defined population within a specific rate of time. Also known as a life table or an actuarial table, mortality tables are used in business by [insurance companies](#) to price insurance products and schemes for individuals.

<https://corporatefinanceinstitute.com/resources/knowledge/other/mortality-table/>

1.2: Salient features in SRS based Abridged Life Tables 2015-19' (India).

- Expectation of life at birth for India has been estimated at 69.7 years for the period 2015-19, exhibiting an increase of 0.3 years from 2014-18. The life expectancy at birth varies from 65.3 years in Chhattisgarh to 75.9 years in Delhi.
- The expectation of life at birth is 68.3 years in rural areas and 73.0 years in urban areas for 2015-19. The life expectancy has increased by 0.3 years and 0.4 years respectively for rural and urban areas as compared to 2015-19.
- At the national level, the life expectancy at birth for males has been estimated at 68.4 years and that for females, at 71.1 years. Expectation of life at birth is highest in Delhi (74.3 years) for males and in Kerala (78.0 years) for females, whereas it is lowest in Chhattisgarh (63.7 years) for males and Uttar Pradesh (66.2 years) for females.

India, 2015-19												
Age-Interval	Total				Male				Female			
x to xx+n	ngx	lx	nLx	ex	ngx	lx	nLx	ex	ngx	lx	nLx	ex
Total												
0-1	0.03679	100000	96866	69.7	0.03571	100000	96948	68.4	0.03804	100000	96820	71.1
1-5	0.00502	96321	384095	71.3	0.00479	96429	384585	69.9	0.00530	96196	383489	72.9
5-10	0.00295	95837	478479	67.7	0.00285	95968	479157	66.3	0.00305	95686	477701	69.2
10-15	0.00280	95555	477106	62.9	0.00285	95695	477793	61.5	0.00275	95394	476318	64.4
15-20	0.00399	95288	475541	58.1	0.00409	95422	476199	56.6	0.00394	95133	474771	59.6
20-25	0.00559	94907	473268	53.3	0.00618	95032	473769	51.8	0.00499	94757	472642	54.8
25-30	0.00678	94377	470345	48.6	0.00782	94444	470459	47.2	0.00573	94285	470106	50.1
30-35	0.00881	93737	466719	43.9	0.01075	93706	466150	42.5	0.00678	93744	467188	45.4
35-40	0.01213	92911	461892	39.2	0.01534	92699	460132	37.9	0.00881	93109	463604	40.7
40-45	0.01726	91784	455187	34.7	0.02109	91277	451837	33.5	0.01317	92288	458584	36.0
45-50	0.02476	90200	445791	30.3	0.03065	89352	440308	29.1	0.01844	91073	451503	31.5
50-55	0.04004	87967	431690	26.0	0.04422	86614	424164	25.0	0.03546	89393	439713	27.0
55-60	0.06500	84444	409322	21.9	0.07612	82783	399103	21.0	0.05390	86223	420197	22.9
60-65	0.09168	78955	377589	18.3	0.10288	76482	363593	17.5	0.07988	81576	392536	19.0
65-70	0.13854	71717	334882	14.8	0.15303	68613	317889	14.2	0.12356	75060	353322	15.5
70-75	0.20161	61781	278708	11.8	0.21934	58114	259449	11.3	0.18407	65785	299804	12.3
75-80	0.28658	49325	211964	9.1	0.30401	45367	192760	8.8	0.26967	53676	233165	9.5
80+85	0.42849	35190	137627	6.8	0.44632	31575	121761	6.6	0.41131	39201	155379	7.0
85+	...	20111	101155	5.0	...	17482	85517	4.9	...	23077	119055	5.2

<https://censusindia.gov.in/nada/index.php/catalog/43473> Page ► 25.

1.3: Life Tables published by the United States of America can be seen in the following link: ♥Courtesy ♥Tables ^ <https://www.irs.gov/retirement-/actuarial-tables>

1. One-life factors for annuities, life estate and remainder table S 2000CM).
2. Two- life remainder factors; (table R (2) 0.20 to 4% (2000CM). 3. Two- life remainder factors; (table R (2) 4.2 to 8% (2000C)
4. Two- life remainder factors; (table R (2) 8.20 to 12.0% (2000C)
5. Two- life remainder factors; (table R (2) 12.20 to 16.0% (2000C)
6. Two- life remainder factors; (table R (2) 16.20 to 20% (2000C)
7. Term certain annuity and income factors: Table B
8. Commutation factors: Table H *2000CM.
9. Adjustment factors for annuity paid at end of year: table K
10. Adjustment factors for annuity paid at beginning of year: table K
11. Mortality table: table 2000CM
12. Factors for remainder interests in depreciable property: table C (2000 CM).

2.0: Glossary: Insurance Hand book-US Government:

Annuitant: The person who receives the income from an annuity contract. Usually the owner of the contract or her or his spouse.

ANNUITY

A life insurance product that pays periodic income benefits for a specific period of time or over the course of the annuitant's lifetime. There are two basic types of annuities: deferred and immediate. Deferred annuities allow assets to grow tax-deferred over time before being converted to payments to the annuitant. Immediate annuities: A product purchased with a lump sum, usually at the time retirement begins or afterwards. Payments begin within about a year. Immediate annuities can be either fixed or variable.

LIFE ANNUITY

A type of annuity contract that guarantees periodic income payments throughout the lifetime of a named individual—the annuitant. If a life annuity provides no further benefits after the death of the annuitant, the annuity is known as a straight life annuity. However, some life annuities provide that income payments will be paid either for the life of the annuitant or for a guaranteed period—life income with period certain—or at least until a guaranteed amount has been paid—life income with refund annuity.

A valuer may be called upon to value a property which is subject to a life interest of a person or persons, and it is for this reason that a thorough knowledge of the

mortality tables, the expectation of life tables and the years purchase for life tables should be had by the valuer.

3.0: Life interest may be of two kinds (J.A. Parks):-

A tenant for life	A lessee for life
He owns the property for the duration of his or her life. She/he cannot sell the property, because after her/his death the property will pass to the reversioner or remainder-man. The tenant for life may sell her/his interest in the property, but the purchaser's interest will only for the duration of the life of the vendor.	A lessee for life holds the property under a lease for the duration of her/his life, subject to the payments of rent and observance of any other clause in the lease in valuing the interest of a lessee for life' the first item will be for the profit rental to be ascertained. The capitalization of the profit rental will be done at the ordinary leasehold rates per cent, instead of the lower percentages which will be applicable for a 'tenant for life.

3.1: ♥ Repealed Wealth tax Rule-1B: Valuation of Life Interest ► *SCHEDULE III* [See Section 7 (1) - RULES FOR DETERMINING THE VALUE OF ASSETS: Part A, General: Valuation of life interest.

Wealth-tax Rules 1957: Year's Purchase Single Life ▼ p = annual premium

$$\text{Valuation of Life} = \frac{1}{P + d} - 1, d =$$

Estate: Formula ► (

$$\frac{i}{1 + i} \text{ "i" being the rate of interest. The rate of interest be taken at 6.50\%,}$$

Wealth-tax Single Life Table is attached in PDF *ut-infra*. (Page-22).

3.2: (JA. Parks): Year's Purchase Single Life (Page 182).

The figure of year's purchase will be made up of series of sums of ₹/- each receivable at the ends of a successive years and continued to be received until, according to the mortality tables adopted, the life ceases to exist. These figures are present value known as contingent values, since the contingent on the person living long enough to receive it for instance, if you were calculating the present value of an of ₹.1/- per annum receivable for the life time of a man aged 102. The present value of ₹1/-

receivable in 1 year at 4% = 0.9615 (Table 2A). From the Carlisle tables you will see that 5 people living at the age of 102, only 3 of them celebrate their 103rd birth day; therefore, the first year's income value would be multiplied by 3/5 or 0.60 being the probability fraction that man will survive another year. For the next year you will find the present value of ₹ 1/- in 2 years' time = 0.9245 and this by probability fraction that the man will survive another year..... and; therefore, the probability fraction is for calculation of the year's purchase:

3.3: The following example shows clearly the process necessary for Calculation of the Year's Purchase. ^ <https://www.irs.gov/retirement-/actuarial-tables>

What is the **Year's Purchase (Y.P)** for a single life at **6.60 per cent** for a person **aged 95**? Probability that a person age 95 will be alive at age 105?

- Present value of ₹1/- at 6.60% , year 1 : 0.9381 (table 2A) **Say 'L'**
- Age 95 by Actuarial Life Table 2022, Male : 6871 Say (A)
- Probability of man aged 95 living to age 96: 5315 Say (B)
- $B \div A$ **0.77354 Say 'M'**

Contingent value: (Present value of ₹1/- at 6.60% in one year by probability fraction: **L x M = 0.7257**). (Mortality table 2000CM).

P	Q	R	S	T	U	V	W	X	Y
pv-1 at 6.60% - Year1	pv-1 at 6.60% - Year2	pv-1 at 6.60% - Year-3	pv-1 at 6.6% - Year-4	pv-1 at 6.6% - Year-5	pv-1 at 6.6% - Year-6	pv-1 at 6.6% - Year-7	pv-1 at 6.6% - Year-8	pv-1 at 6.6% - Year-9	pv-1 at 6.6% - Year-10
(L) 0.9381	0.88	0.8255	0.77441	0.7265	0.6815	0.6393	0.5997	0.5626	0.528
6871	6871	6871	6871	6871	6871	6871	6871	6871	6871
5315	4016	2959	2122	1477	997	650	410	248	144
(M) 0.7735	0.584	0.43065	0.30883	0.215	0.1451	0.946	0.0597	0.036094	0.021
(L +M) 0.7257	0.514	0.3555	0.23916	0.1562	0.0989	0.0605	0.0358	0.02031	0.011

$P+Q+R+S+T+U+V+W+X+Y = 2.217$;

Y.P. for life aged 95 according to the mortality tables at 6.60 per cent = 2.217. (J.A. Parks).

3.3.1: Method – II <https://www.irs.gov/retirement- /actuarial-tables>

Initial age Years	95
Plus terms of years	10
Terminal age	105
N-factor, Table H(6.6), age 95	41.66251
minus N-factor, Table H(6.6), age 105	0.2480161
Difference	41.4145
D-factor, Table H(6.6), age 95	15.852
Required Annuity Factor ▼	
41.4145 ÷ 15.852	2.613

🌀 4.0: Factors Involving One Life and a Term of Years.

4.1: Based on an interest rate of 6.8 percent, the present worth of a temporary annuity of \$1.00 per annum payable annually for 10 years or until the prior death of a person aged 60 is ₹6.6822, determined as follows:

Initial age years	60
Plus terms of years	10
Terminal age	70
N-factor, Table H(6.8), age 60	17431.19
minus N-factor, Table H(6.8), age 70	6130.086
Difference	11301.103
D-factor, Table H(6.8), age 60	1691.236
Required Annuity Factor ▼	
11301.103 ÷ 1691.236 temporary annuity factor	6.6822

4.2: Based on an interest rate of 6.8 per cent, the present worth of ₹1.00 at the death of a person aged 60 provided such death occurs within the first 10 years is ₹0.10336 determined as follows:

Initial age Years	60
Plus terms of years	10
Terminal age	70

M-factor, Table H(6.8), age 60	505.9147
minus M-factor, Table H(6.8), age 70	331.1154
Difference	174.799
D-factor, Table H(6.8), age 60	1691.236
D-factor, Table H(6.8), age 60 = ▼	
174.799 ÷ 1691.236	0.10336

4.3: Based on an interest rate of 6.8 percent, the present worth of the right to receive the income from ₹1.00 for 10 years or until the prior death of a person aged 60 is \$0.45439, determined as follows:

Temporary Annuity Factor (Para 4.1).	6.6822
Required income factor (interest rate 6.80%).	0.068
Present worth	0.45434

4.4: Based on an interest rate of 6.8 per cent the present worth of the right of a person aged 21, if living, to receive ₹1.00 upon attaining age 30 is ₹0.54953, determined as follows:

:

D-factor, Table H(6.8), age 30 Say 'P'	13582.48
divided by D-factor, Table H(6.8), age 21 Say 'Q'	24761.63
Required factor (P divided by Q) ►	0.54853

- the probability that a person age 21 will be alive at age 30 is 0.991611

l_x value, Table 2000CM, page 693, age 30 Say 'R'	97750
l_x value, Table 2000CM, age 21 Say 'S'	98577
Required probability (R divided by S) ►	0.991611

4.5: Based on an interest rate of 6.8 per cent, the present worth of a temporary annuity of ₹1.00 per annum payable in equal monthly installments for 10 years or until; the prior death of a person aged 60 is ₹6.8880, determined as follows: •

Annuity factor from (para 4.1).	6.6822
Monthly Adjustment Factor, Refer Table K, page 691, at 6.8 %	1.308
Required annuity factor	6.8880

5.0: Factors Involving Two Lives and a Term of Years.

5.1: Example: Based on an interest rate of 6.80 per cent, the present worth of the right to receive ₹1.00 at the end of 10 years provided at least one of two persons aged 60 and 65 alive factor is 0.50169, determined as follows:

l_x value, Mortality Table 2000CM, age 60	87595
l_x value, age 70	74794
$1 - ((74794) / 87595))$	0.146138
l_x value, Table 2000CM, age 65	82224
l_x value, age 75	64561
$1 - ((64561) / 82224))$	0.214816
Remainder Factor, Table B – Annuity, Income and Remainder Interests for a term certain, (6.8), 10 year term	0.517950
Required Remainder Factor	$(1 - 0.146138 \times 0.214816) \times 0.517950$
Present worth	0.50169

5.2: Two Lives: Year's Purchase for the joint continuation of Two or more lives: (J.A. Parks). ▼

Formula: Add together the contingent values of a series sum of ₹1 each receivable at the end of successive years continued to be so received until, according to the tables, the elder person ceases to exist.

5.2.1: what is the year's purchase for the joint continuation of 2 lives aged 75 and 101 using mortality tables 2000CM and 3.50 per cent interest?

	Probability of person aged 75 living to age 76 Say (A)	Probability of person aged 101 living to age 102 Say (B)	Present value of ₹1/- in one year Say (C)	Contingent present value of ₹1/- $A*B*C$
1	64561 / 66882	650 / 997	0.9661836	0.6080494
2	62091 / 66882	410 / 997	0.9335107	0.3563916
3	59476 / 66882	248 / 997	0.9018427	0.1004009
4	56721 / 66882	144 / 997	0.8714422	0.1067433
Year's Purchase ►				1.17159

5.2.2:♥ The ascertainment of the **Year's Purchase for** longer of two lives has frequently to be found by a valuer and the following is the correct formula:

"Add together the **Year's Purchase for each single life and subtract the Year's Purchase for the joint continuation the two lives.**

☞ What is the **Year's Purchase for longest of two lives aged 40, and 65 according to the Carlisle tables:**

Y.P. single life aged 40 @ 3 per cent (Carlisle table)	17.142
Y.P. single life aged 65 @ 3 per cent (" ")	8.917
Total ►	26.059
Y.P. Joint continuation of 2 lives aged 40 and 65 @ 3%...Carlisle table	8.006
Y.P. of two lives aged 40 and 65 @ 3%	18.053

▲ (J.A. Parks on page 186). ♥

• **Two live Last-to-Die Factor. (www.irs.gov).**

5.3: Based on an interest rate of 4.20 Per cent, the present worth of ₹1/- due at the death of the last to die of two persons aged 60 and 65 is ₹**0.37309**. Or Table R (2), at age 65-60 at 4.2% ► remainder factor is **0.37309**.

5.3.1: Based on an interest rate of 4.20 per cent, the present worth of ₹1.00 due at the death of last to die of two persons aged 60 and 65 is 0.37309. Refer Table R (2), based on Life Table 2000 CM, on page 220, Section 2-2 will be found the older age 65 and the younger age 60. Across from those ages, under the column headed 4.20 per cent, the remainder factor: 0.37309.

5.3.2: A life estate factor or an annuity factor for the same ages and interest rate can be computed using the following example:

Example: Based on an interest rate of 4.20 per cent, the present worth of the right to receive the use of ₹1.00 until death of the last to die of two persons aged 60 and 65 is: 0.62691, determined as follows:

Remainder Factor from Example 5.3.1.	0.37309
Income Factor: $(1 - 0.37309) =$	0.62691
Income factor	0.62691

5.3.3: Based on an interest rate of 4.2 per cent, the present worth of an annuity of ₹1/- per annum payable at the end of each year until the death of last to die of two persons aged 60 and 65 is ₹14.9264 determined as follows:

Income Factor from Example 5.3.2.	0.62691
Annuity factor: $0.62692 \div 0.042$ (interest: 4.20%)	14.9267

☞ **Income or Annuity Payable for such time as one person survives another:**

5.3.4: Based on an interest rate of 4.2 per cent, the present worth of the right to receive the use of ₹1/- for such time as a person aged 65 survives a person aged 60 is ₹0.07459 determined as follows:

Income Factor from Example 5.3.2	0.62691
Single Life Income Factor from Table S(4.2), age 60	0.55232
Required Income Factor: $(0.62691 - 0.55232)$	0.07459

5.3.5: Based on an interest rate of 4.2 per cent, the present worth of an annuity of ₹1.00 per annum payable annually at for such time as A person aged 65 survives a person aged 60 is ₹1.7760 determined as:

Joint and Survivor Annuity Factor from Example 5.3.3.	14.9264
Single Life Annuity Factor, age 60, From Table S(4.2)	13.1504
Required Annuity Factor: $(14.9264 - 13.1504)$	1.7760

5.4: First- to- Die Factor:

5.4.1: Based on an interest rate of 4.2 per cent, the present worth of ₹1.00 due at the death of the first to die of two persons aged 60 and 65 is ₹0.58839 determined as follows:

Single Life Remainder Factor, aged 60, from Table S(4.2)	0.44768
Single Life Remainder Factor, aged 65, from Table S(4.2)	0.51377
Joint and Survivor Remainder Factor from Example 5.3	0.37309
Required Remainder Factor: $(0.44768 + 0.51377) - (0.37309)$	
Required Remainder Factor	0.58836

5.4.2: Based on an interest rate of 4.2 per cent, the present worth of the right to receive the use of ₹1.00 until the death of the first to die of two persons aged 60 and 65 is ₹0.41153 determined as follows:

First-to-die Remainder Factor from Example 5.4.1	0.58836
Income Factor: $(1 - 0.58836)$	0.41154

5.4.3: Based on an interest rate of 4.2 per cent, the present worth of an annuity of ₹1.00 per annum payable annually until the death of the first to die of two persons aged 60 and 65 is ₹9.8010, determined as follows:

Income Factor from Example 5.4.2	0.41164
Required Annuity Factor: $0.41164 \div 0.042 =$	9.801

6.0: Year's Purchase for the longest of 3 lives: (J.A. Parks on page 187). • The ascertainment of the **Year's Purchase for the** longer of three lives is found by the following formula:

☞ Add together the Year's Purchase for each single life and for the joint continuation of three lives and subtract from this sum the total of the Year's Purchase for the joint continuation of each pair of lives.'

6.1: What is the Year's Purchase for the longest of three lives aged 40, 60 and 102 according to mortality tables and at 4 per cent?

Y.P. Single life aged 40 @ 4% Carlisle tables	13.797
Y.P. Single life aged 60 @ 4%	7.675
Y.P. Single life aged 80 @ 4%	3.246
Say 'M'	24.866

Joint continuation of three lives: Mortality Table – table 2000CM.

	Probability of person aged 40 living to age 41	Probability of person aged 60 living to age 61	Probability of person aged 80 living to age 81		Present value of ₹1/-in one year	Contingent present value of ₹1/-.
1	96223 / 96419	86681/ 87595	47694/ 50819		0.96153385	0.6080494
2	96010 / 96419	85691/ 87595	44475 / 50819		0.9245562	0.3563916
3	95782 / 96419	84620/ 87595	41181 / 50819		0.8889964	0.1004009
Say 'N'						1.0648

Total Year's purchase for 3 single lives and joint continuation of three lives: (M+N):**25.931 Say 'P'.**

Joint Continuation of each pair of lives:

Aged 40 and 60 at 4 % (table :): 8.5530 Say 'R':

	Probability of person aged 40 living to age 41	Probability of person aged 60 living to age 61	Present value of ₹1/-in one year	Contingent present value of ₹1/-.
1	96223 / 96419	86681/ 87595	0.96153385	0.94957
2	96010 / 96419	85691/ 87595	0.9245562	0.90062
3	95782 / 96419	84620/ 87595	0.8889964	0.85313
Say 'S'				2.7033

Aged 60 and 80 at 4 %;

	Probability of person aged 60 living to age 61	Probability of person aged 80 living to age 81	Present value of ₹1/-in one year	Contingent present value of ₹1/-.
1	86681/ 87595	47694/ 50819	0.96153385	0.89299
2	85691/ 87595	44475/ 50819	0.9245562	0.79155
3	84620/ 87595	41181/ 50819	0.8889964	0.69593
Say 'T'				2.38047

Y.P for joint continuation of each pair of lives: (R+S+T): 13.6368 Say 'U'

Y.P. for the longest of 3 lives aged 40, 60 and 80: (P – U) ►12.294

☞ **6.2:** This method of calculating the Year's Purchase for the longest of three lives, whilst being as near accurate as statistics prove, the calculation would be very laborious if three joint lives were of tender years, the formula given by the parry's table page 198 is furnished below:

- let x, y, z represent the three ages (x being the youngest and z the oldest.
- Let w be the age at which the Year's Purchase for single life is the as the Year's Purchase for the joint continuation of two lives y and z.
- Rule – add together the Year's Purchase for the longer of two lives aged [x and y] and [x and z] respectively and subtract from this sum the Year's Purchase for the longer of two lives aged [x and w].

6.2.1: What is the Year's Purchase for the longest three lives aged 20, 30 and 40 using $4^{1/2}$ per cent Carlisle tables.

Y.P. $4^{1/2}\%$ longer of two lives aged 20 and 30	18.933
Y.P. $4^{1/2}\%$ longer of two lives aged 20 and 40	18.473
Say 'X'	37.408

Y.P. joint continuation of lives aged 30 and 40 at $4^{1/2}\%$	12.224
Y.P. single life aged 50 at $4^{1/2}\%$	12.239
Y.P. $4^{1/2}\%$ longer of two lives aged 20 and 50 Say 'Y'	18.018

Y.P. longest of 3 lives aged 20, 30 and 40 at $4\frac{1}{2}\%$ (X – Y)	19.389
--	---------------

(J.A. Parks on page 187-188). ▲

7.0: Application of Valuation Tables: (J.A. Parks). ▼

7.1: Mr. X aged 60 as a life interest in a leasehold property having 10 years unexpired life and producing a net income of ₹1,00,000/- per annum. Mr. Y has a reversionary interest in Mr. X's Estate. What is the present value of Y's interest?

Net Income	₹1,00,000/-
Years purchase 10 Years @ 6.50%	7.18883
Year's purchase single life aged 60 @ 6.50%	6.255
Remainderman's interest	0.93383
Value of remainder	₹93,383/-

7.2: Mr. X aged 70 as a life interest in a leasehold property having 5 years unexpired life and producing a net income of ₹1,00,000/- per annum. Mr. Y has a reversionary interest in Mr. X's Estate. What is the present value of Y's interest?

Net Income	₹1,00,000/-
Years purchase 5 Years @ 6.50%	4.15568
Year's purchase single life aged 70 @ 6.50%	4.380
Remainderman's interest	nil
Value of remainder	₹0.00/-

7.3: what is the present value of a reversion to a leasehold property producing a net income of ₹1,00,000/- per annum? The lease has a life of 50 years but at present is held by a person aged 55 years. The property being between ₹10,00,000 to ₹20,00,000/- in value, the security would be 6.50 per cent. For leasehold add 1 per cent. But as this is a very speculative reversion add another $\frac{1}{2}$ per cent.

Net Income	₹1,00,000/-
Years purchase 50 years @ 8%	12.333
Years purchase single life aged 50 years @ 8% (table number 8)	7.31988
Y.P. for the reversion to remainder of 50 years lease after death of a person now aged 50	5.01312
Value of reversion ₹	5,01,312/-

7.4: What is the present value to the heir of a person aged 60 who has just purchased the life interest held by a person aged 25 in a property producing a net income of ₹1,00,000/- per annum: table - 9:

Net Income	₹1,00,000/-
Years purchase single life aged 25 years @ 6.50%	11.888
Years purchase single life aged 60 years @ 6.50%	6.255
Y.P. for the reversion to an income during the life of a person aged 25 years after the death of a person aged 60	5.633
Value of reversion	₹ 5,63,300/-

8.0: Single Premium for Life Insurance:

A person may be the owner of a property which is subject to a life interest and he may now wish to invest a sum which will accumulate to the amount required after the death of the tenant for life. The rule for ascertainment of the Year's Purchase is:-

- "Find the Year's Purchase for the reversion to a perpetuity after the given life and divide the result by the Year's Purchase for perpetuity plus one".

8.1: What sum should be invested now so that it will accumulate to ₹1/- after the death of a person aged 60? Use 6 per cent Table 9. (Insert required premium and interest rate). Y.P. in perpetuity at 6% = $100 \div 6 = 16.667$. or $1 \div 6$.

Year's Purchase for perpetuity @ 6.0%	16.667
Year's purchase single life aged 60 at 6.00 per cent (Table 9)	6.495478
Y.P. Perpetuity @ 6.00% after death of person aged 60	10.171522
Single Premium: $((10.171522) \div (16.667 + 1))$	0.57574/-
Single Premium	0.57574

8.1.1:

Single Premium	0.57574/-
Year's purchase single life aged 60 at 6.00 per cent (Table 9)	6.495478
Annual Premium: $[0.57574] \div 6.495478 + 1]$	0.07681
Annual Premium	0.07681

8.2: A man recently purchased the life interest in a property of a man aged 60 for ₹10,00,000/-. What sum should be invested now so that he may recover his capital after the death of the life holder?

Amount to be redeemed Say "P"	₹ 10,00,000/-
Single Premium to secure ₹1/- after death of man aged 60 @6.00% (Table). (see <u>ut supra</u> 8.1) Say "Q"	0.57574
Amount to be invested now. (P x Q)	₹5,75,740/-

8.3:♥ Instead of investing a single premium a man may wish to pay an annual premium. The rule for ascertainment of the premium:-

"Divide the Single Premium for an assurance of ₹1/- on the life by the Year's Purchase for the life plus one".

8.3.1: What annual sum should be paid at the beginning of each year to secure ₹1/- after the death of a person aged 60 according to the 6% Tables?

Single Premium (<u>ut supra</u> 8.1.1)	0.57574
Year's purchase single life aged 60 at 6.0 per cent (refer: Table-10)	6.495
Annual Premium ((0.57574) ÷ (6.495 + 1)).	0.07682

8.3.2: A man recently purchased the life interest in a property of a man aged 60 for ₹10,00,000/-. What annual sum should he now pay to secure the recovery of his capital after the death of the tenant for life? (Table: 10.1).

Amount to be redeemed	₹ 10,00,000/-
Annual Premium to secure ₹1/- after death of person aged 60 @ 6.00% (See 8.3.1).	0.07682
Annual Premium.	₹76,820/-

8.3.3: What would be the approximate cost of purchasing an annuity of ₹2,500/-per annum for a man ages 74? Refer Table-9; insert annual premium and interest rate:

Annuity requires	₹ 2,500/-
Year's purchase single life aged 74 at 6.00 per cent (Table-9)	3.855
Add 20% for Insurance risks and premium	0.771
Years' Purchase	4.626
Purchase price of Annuity	₹11,565/-

(J.A. Parks). ▲

9.0: Valuation of Life Estates:-

☞ Mr. X allowed his elder sister Ms. B aged 75 to live in his freehold house rent free. Her only obligations were to pay all applicable taxes and liens and to maintain the property in reasonably good condition, which she has gratefully done. Last year Mr. X passed away and in his will, he left the home to his son Mr. Y, however, Mr. X granted a life estate to his sister to provide for her welfare after his death. The appraisal of the property encumbered by a life estate, i.e. the remaindermen's position.

The steps involved in valuation:

1. Estimate the most likely time of death of the life tenant.
2. Forecast the future value of the property at this time.
3. Discount the forecast future value of the property over the remaining duration of the life estate at the appropriate discount rate.

Table 5.1 Expectation of Life in Years

Age in 1990	Total	<u>White</u>		<u>Black</u>	
		Male	Female	Male	Female
At birth	75.5	72.9	79.6	64.6	73.8
50	29.2	26.9	31.8	22.7	28.3
51	28.3	26.0	30.9	22.0	27.5
52	27.4	25.2	30.0	21.3	26.7
53	26.6	24.4	29.1	20.6	25.9
54	25.8	23.5	28.2	19.9	25.1
55	24.9	22.7	27.3	19.3	24.3
56	24.1	21.9	26.5	18.6	23.6
57	23.3	21.1	25.6	18.0	22.8
58	22.5	20.4	24.8	17.4	22.1
59	21.8	19.6	24.0	16.8	21.3
60	21.0	18.9	23.1	16.2	20.6
61	20.2	18.1	22.3	15.6	19.9
62	19.5	17.4	21.5	15.0	19.2
63	18.8	16.7	20.7	14.4	18.5
64	18.1	16.0	20.0	13.9	17.8
65	17.4	15.4	19.2	13.4	17.2
70	14.0	12.3	15.5	10.9	14.1
75	11.1	9.5	12.1	8.7	11.2
80	8.4	7.2	9.1	6.7	8.6
85 and over	6.2	5.3	6.5	5.1	6.3

Source: *Statistical Abstract of the United States, 1994*. Table No. 116.

- To estimate likely time of death of a life tenant, actuarial tables relating to life expectancy are referred. According to Table, her life expectancy is 12.1 (75+12.1), 87th age.
- The next step is to forecast the future value of the property at the predicted date of death.

Assuming current market value of the property is ₹ 1,50,00,000/-. The predicted date of death is in 12.1 years, and the forecast rate of appreciation is 3% per year, the future value of the property would be $1,50,00,000 \times 1.43 = ₹2,14,50,000/-$ (Table-1A). Or $((1,50,00,000 + (1.03))^{12.1})$. It must be discounted back to present value.

The current value i.e. 2.15 Crores is unencumbered, the valuer is expected to assess the property which is encumbered by a life estate. The appropriate discount rate to apply is a function of the property type, market condition and the expected date of death. The shorter life expectancy has less risk than longer life expectancies, just as the yield rate on a five year gilt is generally lower than the yield on a 10 year gilt. In this example, the property is a residential in a well-established, stable neighborhood, the remaining term is 12.1 years and a 10.00% discount rate would be appropriate.

The valuation: Present value = $FV / (1.10)^{12.1} = ₹2,14,50,000 / 3.1685/-$ i.e.. **₹67,69,765/- or say 67,70,000/=**

As can be seen, the remainderman's interest is valued at ₹67,70,000/=. ☺

• Life tenant's interest:

The market rent in the locality is around ₹20,000/- monthly and annual rent can be assessed at ₹2,40,000/-. Table 2A • Present value of Life Estate:

year	Annual rent savings- 3% annual increase.	Present value factor at 10.00%	Present Value ₹
1	2,40,000	0.9091	2,18,184
2	2,47,200	0.8264	2,04,286
3	2,54,616	0.7513	1,91,293
4	2,62,254	0.6830	1,79,119
5	2,70,122	0.6209	1,67,719
6	2,78,226	0.5645	1,57,059
7	2,86,577	0.5132	1,47,146
8	2,95,176	0.4665	1,37,752
9	3,04,028	0.4241	1,28,948

10	2,56,416	0.3855	98,848
The total present value of the life estate			15,55,265 or 15,55,000/-

(Courtesy): Appraising Partial Interests-Life Estates by David Michael Keating. MAI.

10.0: A person aged 60 donates to State University a remainder interest in her personal residence consisting of a house and land, reserving a life estate interest for herself. At the time of the gift the land has a value of \$50,000/- and the house (i.e. the improvements) has a value of \$200,000/- with an estimated useful life of 45 years, and the salvage value of the improvements is considered to be \$10,000. The donor elects to use the interest rate for the month in which the gift takes place, which is 4.6 percent. Using Table C (4.6) on page 23, under the Remainder Factor column and across from age 60 is the factor 0.41890. Thus the present worth of the remainder interest in \$1.00 payable at the death of a person aged 60 is \$0.41890. The present value of no depreciable property is \$60,000 (\$50,000 for land plus \$10,000 salvage value) times 0.41890 or **\$25,134.00**. The factor for valuing the remainder interest in the depreciable portion of the property is computed as follows:

R-factor for initial age of tenant: Table C (4.6), age 60	42414.02
minus (2) R-factor for terminal age of tenant: Table C (4.6), age 105	1.818015
Difference Say P	42412.20
D-factor for initial age of tenant: Table C (4.6), age 60	5896.282
times (5) Useful lifetime of house	45
Product Say Q	265332.69
$P \div Q$ above = $42412.20 \div 265332.69 =$ Say 'S'	0.15985
Remainder factor, table C(4.6) Say 'R'	0.41890
R minus S (Depreciation remainder factor) Say 'T'	0.25905
The present value of the remainder interest in the depreciable part of the gift is \$190,000 (\$200,000 house value minus \$10,000 salvage value = 190000×0.25905)	49,219.50
The present value of the remainder interest in the entire property (<u>25,134</u> +49219.50) US\$	74,353.50.

Table C (4.60) - 2000CM is attached in excel:



11.0: Conclusion:

The author has used Single life year's purchase based on annual premium and formula given in 'Rule IB' of Wealth-tax Rules 1957, Life Estate valuation table 9 compiled by the author in 'Excel' (attached), suitably adopting required premium as per Life Estate Table and required interest rates. Immovable property valuers are required to follow rules, regulations and ethics dictated by CBDT/other Regulators. Knowledge in valuation of Life estate is a must for an immovable property valuer.

(Courtesy):► Life estate is a unique type of partial Interest. In this form of estate, a designated beneficiary, the life tenant, *has* the right to use and occupy a parcel of real estate for *the* duration of her or his life. The life tenant generally enjoys this right without any obligation to pay rent, but typically she or he must maintain the property and pay all applicable liens and taxes The owner of a real property encumbered by a life estate Is called the *remainder man*; she or he enjoys the remaining rights to the property once the life tenant is deceased.

MEDI-CAL ELIGIBILITY PROCEDURES MANUAL		
SECTION 50425, 50442; Manual Letter No.: 312	Date: 12/16/2019	9A-10

LIFE ESTATE VALUE TABLE

Based on the California State Gift Inheritance Tax Formula and the Internal Revenue Service Actuarial Table

AGE	LIFE ESTATE VALUE FACTOR	AGE	LIFE ESTATE VALUE FACTOR	AGE	LIFE ESTATE VALUE FACTOR	AGE	LIFE ESTATE VALUE FACTOR
1	.98988	28	.96062	55	.80046	82	.40295
2	.99017	29	.95813	56	.79006	83	.38642
3	.99008	30	.95543	57	.77931	84	.36998
4	.98981	31	.95254	58	.76822	85	.35359
5	.98938	32	.94942	59	.75675	86	.33764
6	.98884	33	.94608	60	.74491	87	.32262
7	.98822	34	.94250	61	.73267	88	.30859
8	.98748	35	.93868	62	.72202	89	.29526
9	.98663	36	.93460	63	.70696	90	.28221
10	.98565	37	.93026	64	.69352	91	.26955
11	.98453	38	.92567	65	.67970	92	.25771
12	.98329	39	.92083	66	.66551	93	.24692
13	.98198	40	.91571	67	.65098	94	.23728
14	.98066	41	.91030	68	.63610	95	.22887
15	.97937	42	.90457	69	.62086	96	.22181
16	.97815	43	.89855	70	.60522	97	.21550
17	.97700	44	.89221	71	.58914	98	.21000
18	.97590	45	.88558	72	.57261	99	.20486
19	.97480	46	.87863	73	.55571	100	.19975
20	.97365	47	.87137	74	.53862	101	.19532
21	.97245	48	.86374	75	.52149	102	.19054
22	.97120	49	.85578	76	.50441	103	.18437
23	.96986	50	.84743	77	.48742	104	.17856
24	.96841	51	.83674	78	.47049	105	.16962
25	.96678	52	.82969	79	.45357	106	.15488
26	.96495	53	.82028	80	.43659	107	.13409
27	.96290	54	.81054	81	.41967	108	.10068

Reserving a Life Estate and Creating a Remainder Estate Ms. 'B', aged 77, is the owner of a freehold residential plot valued at ₹75,00,000/- has decided to settle a residential plot to her son, Mr. Y for a consideration of ₹20, 00,000/= subject to a reservation of a life estate to her. Ms. 'B' life tenant factor is calculated as a female aged 77 years i.e. her life tenant factor is 0.48742 according to the table attached in PDF. The value of the life estate is ₹20, 00,000 x 0.48742 = ₹9, 74,840/-. Therefore, the value of the remainder estate is **₹20,00,000 - ₹9,74,840 = ₹10,25,160/-** or referring table remainder factor (1-0.48742:0.51258) for aged 77 is 0.51258 = ₹20,00,000 x 0.51258 = ₹10,25,160/=-.

A.M. Ibrahim. FIV, MIBC, FICA. • Registered Architect under Indian Architects Act 1972 and Registered Immovable Property Valuer under Section 34 AB in the wealth-tax act 1957.●

Reference: Courtesy:

1. Observation on Reversionary Payments: BY WILLIAM MORGAN, F.R.S., Seventh Edition, Volume 2, and London 1812. (Google Digitized Book).
2. The Principles and Doctrine of Assurances, Annuities on Lives, and Contingent Reversions by WILLIAM MORGAN, F.R. S, Actuary to the Society for Equitable Assurances on and Survivorships, London: Printed for Longman, Hurst Rees, Orme and Brown, Faternoster Row. 1821.
3. Actuarial Valuation – Version 3A: Internal Revenue Service Publication 1457(5-2009) Catalog Number 63854M
4. Publication 1459 (Rev. 5-2009) Catalog Number 10720V Department of the Treasury Internal Revenue Service www.irs.gov; Actuarial Valuations Version 3C
5. Principles & Practice of VALUATIONS (Land and Houses) by J.A. Parks. F.S.I, Fourth Edition, published Eastern Law House – 1977.
6. Life Estate and Remainder Interest Tables: Appendix Page A-18-1; Citations: 26 CFR 20.2031-7. - Revenue Ruling SDA011.

Disclaimer ♥ *This is a non-profit making publication, intended for valuers fraternity but also to all others interested in the matter.* ♥ .

Attachment.

1. Life Estate Valuation Report Format.



2. Single Life - Life Estate Valuation Tables.



🌀 Institution of Valuers (India) Award and Accolade 🌀:▼

Award and Accolade	Topic of Articles contributed	Year Received
Merit Certificate	Indian Valuers and International Valuation Standards.	2010
	Principles of Property Valuation.	2013
Bronze Medal	Valuation of Financial Instruments.	2019
Gold Medal	● Valuation Methods Under International Valuation Standards (IVS). ● A Study of Bill LARR 2011 (Draft of National Land Acquisition, Rehabilitation and Resettlement Bill).	2011

Dr. B.N. Gupta Award	Business Valuation.	2018
Best Informative Article Award , the first recipient	Valuation for purposes of Liquidation	2021

