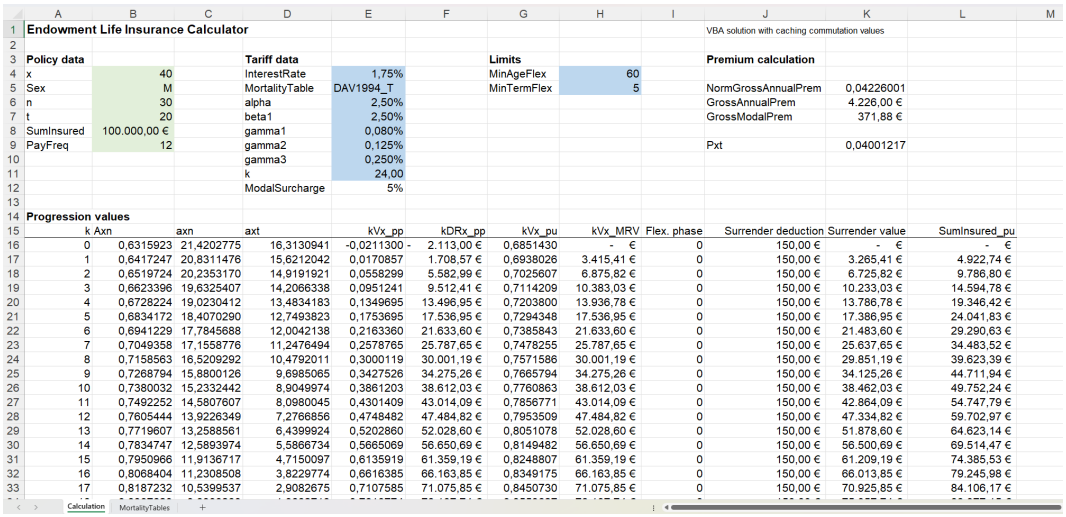
Prompt 5: Preparation for the Translation of the “Calculation” Worksheet

This is a screenshot of a tariff calculator in Excel. Can you provide me with a list of the input and output parameters?

< Insert screenshot of the premium calculator here>



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Endowment Life Insurance Calculator**									VBA solution with caching commutation values			
2													
3	**Policy data**			**Tariff data**			**Limits**			**Premium calculation**			
4	x	40		InterestRate	1,75%		MinAgeFlex	60					
5	Sex	M		MortalityTable	DAV1994_T		MinTermFlex	5		NormGrossAnnualPrem	0,04226001		
6	n	30		alpha	2,50%					GrossAnnualPrem	4.226,00 €		
7	t	20		beta1	2,50%					GrossModalPrem	371,88 €		
8	SumInsured	100.000,00 €		gamma1	0,080%								
9	PayFreq	12		gamma2	0,125%					Pxt	0,04001217		
10				gamma3	0,250%								
11				k	24,00								
12				ModalSurcharge	5%								
13													
14	**Progression values**												
15	k	Axn	axn	axt	kVx_pp	kDRx_pp	kVx_pu	kVx_MRV	Flex. phase	Surrender deduction	Surrender value	SumInsured_pu	
16	0	0,6315923	21,4202775	16,3130941	-0,0211300 -	2.113,00 €	0,6851430	- €	0	150,00 €	- €	- €	
17	1	0,6417247	20,8311476	15,6212042	0,0170857	1.708,57 €	0,6938026	3.415,41 €	0	150,00 €	3.265,41 €	4.922,74 €	
18	2	0,6519724	20,2353170	14,9191921	0,0558299	5.582,99 €	0,7025607	6.875,82 €	0	150,00 €	6.725,82 €	9.786,80 €	
19	3	0,6623396	19,6325407	14,2066338	0,0951241	9.512,41 €	0,7114209	10.383,03 €	0	150,00 €	10.233,03 €	14.594,78 €	
20	4	0,6728224	19,0230412	13,4834183	0,1349695	13.496,95 €	0,7203800	13.936,78 €	0	150,00 €	13.786,78 €	19.346,42 €	
21	5	0,6834172	18,4070290	12,7493823	0,1753695	17.536,95 €	0,7294348	17.536,95 €	0	150,00 €	17.386,95 €	24.041,83 €	
22	6	0,6941229	17,7845688	12,0042138	0,2163360	21.633,60 €	0,7385843	21.633,60 €	0	150,00 €	21.483,60 €	29.290,63 €	
23	7	0,7049358	17,1558776	11,2476494	0,2578765	25.787,65 €	0,7478255	25.787,65 €	0	150,00 €	25.637,65 €	34.483,52 €	
24	8	0,7158563	16,5209292	10,4792011	0,3000119	30.001,19 €	0,7571586	30.001,19 €	0	150,00 €	29.851,19 €	39.623,39 €	
25	9	0,7268794	15,8800126	9,6985065	0,3427526	34.275,26 €	0,7665794	34.275,26 €	0	150,00 €	34.125,26 €	44.711,94 €	
26	10	0,7380032	15,2332442	8,9049974	0,3861203	38.612,03 €	0,7760863	38.612,03 €	0	150,00 €	38.462,03 €	49.752,24 €	
27	11	0,7492252	14,5807607	8,0980045	0,4301409	43.014,09 €	0,7856771	43.014,09 €	0	150,00 €	42.864,09 €	54.747,79 €	
28	12	0,7605444	13,9226349	7,2766856	0,4748482	47.484,82 €	0,7953509	47.484,82 €	0	150,00 €	47.334,82 €	59.702,97 €	
29	13	0,7719607	13,2588561	6,4399924	0,5202860	52.028,60 €	0,8051078	52.028,60 €	0	150,00 €	51.878,60 €	64.623,14 €	
30	14	0,7834747	12,5893974	5,5866734	0,5665069	56.650,69 €	0,8149482	56.650,69 €	0	150,00 €	56.500,69 €	69.514,47 €	
31	15	0,7950966	11,9136717	4,7150097	0,6135919	61.359,19 €	0,8248807	61.359,19 €	0	150,00 €	61.209,19 €	74.385,53 €	
32	16	0,8068404	11,2308508	3,8229774	0,6616385	66.163,85 €	0,8349175	66.163,85 €	0	150,00 €	66.013,85 €	79.245,98 €	
33	17	0,8187232	10,5399537	2,9082675	0,7107585	71.075,85 €	0,8450730	71.075,85 €	0	150,00 €	70.925,85 €	84.106,17 €	

Calculation | MortalityTables

Result: Description of the input and output parameters

Prompt 6: Translation of the Formulas of the "Calculation" Worksheet

Next, I would like you to transform the formulas that appear under "Premium Calculation" and in the table "Progression Values" into Python functions. The formulas are as follows:

"

NormGrossAnnualPrem=(act_nGrAx(x;n;Sex;MortalityTable;InterestRate)+Act_Dx(x+n;Sex;MortalityTable;InterestRate)/Act_Dx(x;Sex;MortalityTable;InterestRate)+gamma1*Act_axn_k(x;t;Sex;MortalityTable;InterestRate;1)+gamma2*(Act_axn_k(x;n;Sex;MortalityTable;InterestRate;1)- Act_axn_k(x;t;Sex;MortalityTable;InterestRate;1)))/((1-beta1)*Act_axn_k(x;t;Sex;MortalityTable;InterestRate;1)-alpha*t)

GrossAnnualPrem=SumInsured*K5

GrossModalPrem=(1+ModalSurcharge)/PayFreq*(K6+k)

Pxt=(act_nGrAx(x;n;Sex;MortalityTable;InterestRate)+Act_Dx(x+n;Sex;MortalityTable;InterestRate)/Act_Dx(x;Sex;MortalityTable;InterestRate)+t*alpha*NormGrossAnnualPrem)/Act_axn_k(x;t;Sex;MortalityTable;InterestRate;1)

Axn=IF(A16<=n;act_nGrAx(x+$A16;MAX(0;n-$A16);Sex;MortalityTable;InterestRate)+Act_Dx(x+n;Sex;MortalityTable;InterestRate) / Act_Dx(x+$A16;Sex;MortalityTable;InterestRate);0)

axn=Act_axn_k(x+$A16;MAX(0;n-$A16);Sex;MortalityTable;InterestRate;1)

axt= Act_axn_k(x+$A16;MAX(0;t-$A16);Sex;MortalityTable;InterestRate;1)

kVx_pp = B16-P_xt*D16+gamma2*(C16-Act_axn_k(x;n;Sex;MortalityTable;InterestRate;1)/Act_axn_k(x;t;Sex;MortalityTable;InterestRate;1)*D16)

kDRx_pp= SumInsured*E16

kVx_pu=B16+gamma3*C16

kVx_MRV= F16+alpha*t* GrossAnnualPrem *Act_axn_k(x+A16;MAX(5-A16;0);Sex;MortalityTable;InterestRate;1)/Act_axn_k(x; 5; Sex; MortalityTable; InterestRate;1)

Flex. phase=IF(AND(x+A16>=MinAgeFlex;A16>=n-MinTermFlex);1;0)

Surrender deduction=IF(OR(A16>n;I16);0;MIN(150;MAX(50;1%*(SumInsured-F16))))

Surrender value =MAX(0;H16-J16)

SumInsured_pu=IFERROR(IF(A16>n;0;IF(A16<t;H16/G16;SumInsured));0)

"

You may assume that the VBA functions used in the formulas are already available as Python functions. The functions act_nGrAx and Act_axn_k are defined in the module presentvalues.py, and the function Act_Dx is located in the module commvalues.py.

Create a Python module that calculates the premium calculation and the progression values exactly as in the Excel premium calculator. The module should be named premium_and_progress_values. We will create the main program for this later.

Result: premium_and_progress_values.py

Prompt 7: Generation of the Main Program

Thank you. The module has been implemented as "premium_and_progress_values.py". Please create a main program that calculates the values from the “Premium Calculation” section and all progress values, and outputs them to the screen.

The main program should read the input parameters from the Excel file "Tariff_Calculator.xlsm", worksheet "Calculation".

The output file should be named “tariff_calculator.py”

To read the input parameters from the correct cells, please refer to the screenshot.

< Insert screenshot of the tariff calculator here >

Result: tariff_calculator.py

Prompt 8: Generation of a Comparison Program

Thank you very much. I would now like to create a program that checks whether the results produced by the Python code match the values in the Excel file. The program should read the input parameters from the Excel file "Tariff_Calculator.xlsm", worksheet "Calculation".

To read the input parameters from the correct cells, please refer again to the screenshot.

The output file should be named compare.py.

< Insert screenshot of the tariff calculator here >

Result: compare.py
