Exercise 7.17

Example 7.1 is a fully discrete 20-year endowment policy of 500000 issued to a select life age 50. The annual premium was determined to be $P = 15114.33$. To calculate interim policy values between $t = 0$ and $t = 2$, starting with ${}_0V = 0$, we apply recursion formulas as follows:

$${}_hV = \frac{P(1.06)^h - 500000v^{1-h}\ {}_hq_{[50]}}{1 - {}_hq_{[50]}}, \quad \text{for } h = 0.1, 0.2, \ldots, 1.0,$$

and

$${}_hV = \frac{({}_1V + P)(1.06)^{h-1} - 500000v^{2-h}\ {}_{h-1}q_{[50]+1}}{1 - {}_{h-1}q_{[50]+1}}, \quad \text{for } h = 1.1, 1.2, \ldots, 2.0,$$

where $v = 1/1.06$, the applicable discount factor. Note that we have to separate the calculation of interim policy values between years 1 and 2 because premiums are paid only once at the beginning of the year and death benefit is paid at the end of the year of death, which explains the discounting of the benefit for interim deaths.

The results, which can be easily verified using a software or a spreadsheet, of the calculations are summarized below (the mortality rates are given for convenience):

h	${}_hq_{[50]}$	${}_hV$	h	${}_{h-1}q_{[50]+1}$	${}_hV$
0.0		0.00			
0.1	0.0000943	15144.56	1.1	0.0001153	30581.05
0.2	0.0001905	15173.83	1.2	0.0002329	30677.66
0.3	0.0002886	15202.11	1.3	0.0003529	30773.38
0.4	0.0003887	15229.36	1.4	0.0004754	30868.19
0.5	0.0004908	15255.56	1.5	0.0006004	30962.03
0.6	0.0005950	15280.65	1.6	0.0007279	31054.87
0.7	0.0007013	15304.61	1.7	0.0008580	31146.66
0.8	0.0008098	15327.39	1.8	0.0009907	31237.36
0.9	0.0009204	15348.96	1.9	0.0011262	31326.91
1.0	0.0010333	15369.28	2.0	0.0012644	31415.28