Annuity Symbols

Type of Coverage	Payable Continuously	Payable at Beginning of Year	Payable at Beginning of mth
whole life annuity	$\overline{a}_x = \frac{1-\overline{A}_x}{\delta}$	$\ddot{a}_x = \frac{1-A_x}{d}$	$\ddot{a}_x^{(m)} = \frac{1-A_x^{(m)}}{d^{(m)}}$
n-year temporary life annuity	$\overline{a}_{x:\overline{n}\rceil} = \frac{1-\overline{A}_{x:\overline{n}\rceil}}{\delta}$	$\ddot{a}_{x:\overline{n}\rceil} = \frac{1-A_{x:\overline{n}\rceil}}{d}$	$\ddot{a}_{x:\overline{n}\rceil}^{(m)} = \frac{1-A_{x:\overline{n}\rceil}^{(m)}}{d^{(m)}}$
n-year deferred life annuity	${}_{n\|}\overline{a}_x = {}_nE_x \cdot \overline{a}_{x+n} = \overline{a}_x - \overline{a}_{x:\overline{n}\rceil}$	${}_{n\|}\ddot{a}_x = {}_nE_x \cdot \ddot{a}_{x+n} = \ddot{a}_x - \ddot{a}_{x:\overline{n}\rceil}$	${}_{n\|}\ddot{a}_x^{(m)} = {}_nE_x \cdot \ddot{a}_{x+n}^{(m)} = \ddot{a}_x^{(m)} - \ddot{a}_{x:\overline{n}\rceil}^{(m)}$
n-year certain and life annuity	$\overline{a}_{\overline{x:\overline{n}\rceil}} = \overline{a}_{\overline{n}\rceil} + {}_{n\|}\overline{a}_x$	$\ddot{a}_{\overline{x:\overline{n}\rceil}} = \ddot{a}_{\overline{n}\rceil} + {}_{n\|}\ddot{a}_x$	$\ddot{a}_{\overline{x:\overline{n}\rceil}}^{(m)} = \ddot{a}_{\overline{n}\rceil}^{(m)} + {}_{n\|}\ddot{a}_x^{(m)}$

Annuity Formulas

Type of Coverage	Payable Continuously	Payable at Beginning of Year	Payable at Beginning of mth
General Formula	$\int_a^b v^t \, {}_tp_x \, dt$	$\sum_{k=a}^{b} v^k \, {}_kp_x$	$\sum_{k=a}^{b} \frac{1}{m} v^{k/m} \, {}_{\frac{k}{m}}p_x$
whole life annuity	$a=0; b=\infty$ or end of table	$a=0; b=\infty$ or end of table	$a=0; b=\infty$ or end of table
n-year temporary life annuity	$a=0; b=n$	$a=0; b=n-1$	$a=0; b=nm-1$
n-year deferred life annuity	$a=n; b=\infty$ or end of table	$a=n; b=\infty$ or end of table	$a=nm; b=\infty$ or end of table

Variances

Type of Coverage	Payable Continuously	Payable at Beginning of Year	Payable at Beginning of mth
whole life annuity	$\frac{{}^2\overline{A}_x - (\overline{A}_x)^2}{\delta^2}$	$\frac{{}^2A_x - (A_x)^2}{d^2}$	$\frac{{}^2A_x^{(m)} - (A_x^{(m)})^2}{[d^{(m)}]^2}$
n-year life annuity	$\frac{{}^2\overline{A}_{x:\overline{n}\rceil} - (\overline{A}_{x:\overline{n}\rceil})^2}{\delta^2}$	$\frac{{}^2A_{x:\overline{n}\rceil} - (A_{x:\overline{n}\rceil})^2}{d^2}$	$\frac{{}^2A_{x:\overline{n}\rceil}^{(m)} - (A_{x:\overline{n}\rceil}^{(m)})^2}{[d^{(m)}]^2}$

Relationships

$\ddot{a}_{x:\overline{n}\vert} = \ddot{a}_x - {}_nE_x \cdot \ddot{a}_{x+n}$	$\bar{a}_{x:\overline{n}\vert} = \bar{a}_x - {}_nE_x \cdot \bar{a}_{x+n}$	$\ddot{a}^{(m)}_{x:\overline{n}\vert} = \ddot{a}^{(m)}_x - {}_nE_x \cdot \ddot{a}^{(m)}_{x+n}$	$\ddot{a}_x = 1 + vp_x \cdot \ddot{a}_{x+1}$	$\ddot{a}^{(m)}_x = \frac{1}{m} + v^{\frac{1}{m}} \cdot {}_{\frac{1}{m}}p_x \cdot \ddot{a}^{(m)}_{x+1/m}$	$\ddot{a}_{x:\overline{n}\vert} = 1 + vp_x \cdot \ddot{a}_{x+1:\overline{n-1}\vert}$
$\bar{A}_x = 1-\delta\bar{a}_x$	$\bar{A}_{x:\overline{n}\vert} = 1-\delta\bar{a}_{x:\overline{n}\vert}$	$A_x = 1-d\ddot{a}_x$	$A_{x:\overline{n}\vert} = 1-d\ddot{a}_{x:\overline{n}\vert}$	$A^{(m)}_x = 1-d^{(m)}\ddot{a}^{(m)}_x$	$A^{(m)}_{x:\overline{n}\vert} = 1-d^{(m)}\ddot{a}^{(m)}_{x:\overline{n}\vert}$
$a_x = \ddot{a}_x - 1$	$a_{x:\overline{n}\vert} = \ddot{a}_{x:\overline{n+1}\vert} - 1$	$a_{x:\overline{n}\vert} = \ddot{a}_{x:\overline{n}\vert} - 1 + {}_nE_x$	$a^{(m)}_x = \ddot{a}^{(m)}_x - \frac{1}{m}$	$a_{x:\overline{n}\vert} = \ddot{a}^{(m)}_{x:\overline{n}\vert} - \frac{1}{m} + \frac{1}{m} \cdot {}_nE_x$	
${}_{n\vert}a_x = {}_{n+1\vert}\ddot{a}_x$	$a_{\overline{x:\overline{n}\vert}} = a_{\overline{n}\vert} + {}_{n+1\vert}\ddot{a}_x$		$(I\ddot{a})_x = \sum_{t=0}^{\infty} v^t (t+1)\,{}_tp_x$	$(I\ddot{a})_{x:\overline{n}\vert} = \sum_{t=0}^{n-1} v^t (t+1)\,{}_tp_x$	$(\bar{I}\bar{a})_{x:\overline{n}\vert} = \int_0^n t \cdot v^t \cdot {}_tp_x \cdot dt$

Alpha/Beta Formula (Exact if UDD)

$$\ddot{a}^{(m)}_x = \alpha(m)\ddot{a}_x - \beta(m)$$

$$\bar{a}_x = \alpha(\infty)\ddot{a}_x - \beta(\infty)$$

2-Term Woolhouse Approximation (see SULT Packet)

$$\ddot{a}^{(m)}_x = \ddot{a}_x - \frac{m-1}{2m}$$

$$\ddot{a}^{(m)}_x = \ddot{a}_x - \frac{m-1}{2m}$$

$$\bar{a}_x = \ddot{a}_x - \frac{1}{2}$$