More status $\frac{x}{n}$ when they fail

<table>
<thead>
<tr>
<th>$T$</th>
<th>fails when</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x &gt; \frac{n}{2}$</td>
<td>first one dies if before $t = n$</td>
</tr>
<tr>
<td>$t = n$</td>
<td>if both are alive then</td>
</tr>
<tr>
<td>$\frac{n}{2} &lt; x &lt; n$</td>
<td>last one dies if before $t = n$</td>
</tr>
<tr>
<td>$t = n$</td>
<td>if at least one is still alive then</td>
</tr>
<tr>
<td>$x &lt; \frac{n}{2}$</td>
<td>last one dies if after $t = n$</td>
</tr>
<tr>
<td>$t = n$</td>
<td>if both are dead then</td>
</tr>
</tbody>
</table>

Annuity pays while both are alive, for up to $n$ years

Annuity pays while at least one is alive, for up to $n$ years

Annuity pays while for $n$ years certain and while at least one is alive thereafter

H.W. When does the status $\sigma = \frac{x}{n}$ fail?

Recall $T_{xy} = \min (T_x, T_y)$

$T_{\frac{x}{y}} = \max (T_x, T_y)$

Discount Factors

Interest Discount: $2^n$

Actuarial Discount: $nE_x = 2^n \cdot nP_x$

$v = \text{periodic discount factor}$
M.352: Discrete Annuities

Examples:

1) Whole-Life (WL)

\[ \text{payments are certain} \]

\[ v = \text{pdf} \]

\[ PV = \ddot{a}_x \cdot \frac{VEP}{1 + v + v^2 + \cdots} \quad T = \text{LTAM Tables} \]

\[ APV = \ddot{a}_x \cdot \frac{VEP}{1 + v P_x + v^2 \cdot 2 P_x + \cdots} \quad (\text{See T}) \]

Remark: \( \ddot{a}_x = \ddot{a}_x - 1 \)

2) n-year deferred, whole life

\[ \text{payments are all life contingent} \]

\[ APV = n^\ddot{a}_x \cdot \frac{VEP}{1 + v P_x + v^{n+1} P_{x+1} + v^{n+2} P_{x+2} + \cdots} \]

Remark: \( n^\ddot{a}_x = \sum_{n} v^n P_x \cdot \ddot{a}_{x+n} \quad (\text{See T}) \)

\[ \sum_{n} \text{Ex} \]