Seminari 14

Matematika za ekonomiste 2

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Sadržaj

Teorija

prvi zadatak

drugi zadatak treći zadatak

četvrti zadatak

peti zadatak

Teorija

Oznake

• $D_x \rightarrow$ diskontirani broj živih osoba starosti x

$$D_{x} = \ell_{x} \cdot v^{x}, \qquad v = \frac{1}{r}$$

ullet $N_x
ightarrow {\sf zbroj}$ diskontiranih živih osoba starijih od x godina

$$N_x = D_x + D_{x+1} + \cdots + D_{\omega}$$

• $C_x \rightarrow$ diskontirani broj umrlih osoba starosti x

$$C_{x} = d_{x} \cdot v^{x+1}$$

ullet $M_{x}
ightarrow {\sf zbroj}$ diskontiranih umrlih osoba starijih od x godina

$$M_x = C_x + C_{x+1} + \cdots + C_{\omega}$$

Princip ekvivalencije

- Premija → uplata osiguranika (kotizacija)
- Princip ekvivalencije

Sadašnja vrijednost matematički očekivanih uplata mora biti jednaka sadašnjoj vrijednosti matematički očekivanih isplata.

premija = osigurana svota · koeficijent
 Kod različitih vrsta osiguranja koeficijent se računa po drukčijoj formuli i ima drukčiju oznaku.

 $\mathbf{B} = \mathbf{S} \cdot \text{koeficijent}$

Premije u osiguranju života

Poopćenje osobnih renti (periodskih isplata)

- Neodgođena doživotna osobna renta
- Neodgođena osobna renta trajanja *n* godina
- Za *n* godina odgođena doživotna renta (starosna renta)

Nekoliko posebnih vrsta osiguranja

- Osiguranje za slučaj doživljenja
- Osiguranje za slučaj smrti
 - Doživotno osiguranje za slučaj smrti
 - Privremeno osiguranje za slučaj smrti
- Mješovito osiguranje

Neodgođena doživotna osobna renta

Nakon uplate premije osiguraniku se doživotno isplaćuje renta

$$\ddot{a}_{x} = 1 + \frac{D_{x+1}}{D_{x}} + \frac{D_{x+2}}{D_{x}} + \dots + \frac{D_{\omega}}{D_{x}} = \frac{N_{x}}{D_{x}}$$
$$B = S \cdot \ddot{a}_{x}$$

Neodgođena osobna renta trajanja n godina

Nakon uplate premije osiguraniku se n godina isplaćuje renta

$$\ddot{a}_{x:n} = 1 + \frac{D_{x+1}}{D_x} + \frac{D_{x+2}}{D_x} + \dots + \frac{D_{x+n-1}}{D_x} = \frac{N_x - N_{x+n}}{D_x}$$

$$B = S \cdot \ddot{a}_{x:n}$$

Za n godina odgođena doživotna renta (starosna renta)

 Nakon uplate premije osiguraniku se doživotno isplaćuje renta tek nakon isteka n godina

$$a_n \ddot{a}_x = \frac{D_{x+n}}{D_x} + \frac{D_{x+n+1}}{D_x} + \dots + \frac{D_\omega}{D_x} = \frac{N_{x+n}}{D_x}$$

$$B = S \cdot {}_{n} \ddot{a}_x$$

Osiguranje za slučaj doživljenja

 Nakon uplate premije osiguraniku se nakon n godina isplaćuje osigurana svota.

$$_{n}E_{x}=\frac{D_{x+n}}{D_{x}}, \qquad B=S\cdot _{n}E_{x}$$

Doživotno osiguranje za slučaj smrti

 Nakon uplate premije osiguranikovoj se obitelji nakon njegove smrti isplaćuje osigurana svota

$$A_{x} = \frac{C_{x}}{D_{x}} + \frac{C_{x+1}}{D_{x}} + \dots + \frac{C_{\omega}}{D_{x}} = \frac{M_{x}}{D_{x}}$$

$$B = S \cdot A_{x}$$

Privremeno osiguranje za slučaj smrti s trajanjem n godina

 Nakon uplate premije, u slučaju smrti osiguranika u idućih n godina, osiguranikovoj se obitelji isplaćuje osigurana svota

$$_{|n}A_{x} = \frac{C_{x}}{D_{x}} + \frac{C_{x+1}}{D_{x}} + \dots + \frac{C_{x+n-1}}{D_{x}} = \frac{M_{x} - M_{x+n}}{D_{x}}$$
 $B = S \cdot {_{|n}A_{x}}$

Mješovito osiguranje

• osiguranje za slučaj doživljenja + osiguranje za slučaj smrti

Jednokratna uplata

$$A_{x:n} = {}_{n}E_{x} + {}_{\mid n}A_{x} = \frac{D_{x+n} + M_{x} - M_{x+n}}{D_{x}}$$

$$B = S \cdot A_{x:n}$$

Godišnja uplata

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

Dostatna premija mješovitog osiguranja – uključuje troškove

- troškovi zaključenja (akvizicijski) jednokratni
 - stopa troškova α
- inkaso troškovi troškovi prikupljanja premija
 - stopa troškova β
- ullet upravni troškovi stopa troškova γ

Jednokratna uplata

$$A_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{1 - \beta}, \qquad B = S \cdot A_{x:n\rceil}^{a}$$

Godišnja uplata

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}, \qquad B = S \cdot P_{x:n]}^{a}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

 $B = S \cdot {}_{n}E_{x}$ ${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$

Zadatak 1

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40}=rac{D_{65}(m)}{D_{40}(m)}=$$

 $B = S \cdot {}_{n}E_{x}$ ${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$

Zadatak 1

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40}=\frac{D_{65}(m)}{D_{40}(m)}=$$

 $B = S \cdot {}_{n}E_{x}$ ${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$

Zadatak 1

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{}$$

$$B = S \cdot {}_{n}E_{x}$$

$${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24\,594.50}$$

 $B = S \cdot {}_{n}E_{x}$ $R_{x} = \frac{D_{x+n}}{D_{x}}$

Zadatak 1

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24\,594.50} = 0.338379$$

$$B = S \cdot {}_{n}E_{x}$$

$${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24594.50} = 0.338379$$

$$B = S \cdot {}_{25}E_{40} =$$

$$B = S \cdot {}_{n}E_{x}$$

$${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24594.50} = 0.338379$$

$$B = S \cdot {}_{25}E_{40} = 8000$$

$$B = S \cdot {}_{n}E_{x}$$

$${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24594.50} = 0.338379$$

$$B = S \cdot {}_{25}E_{40} = 8000 \cdot 0.338379$$

$$B = S \cdot {}_{n}E_{x}$$

$${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24\,594.50} = 0.338379$$

$$B = S \cdot_{25} E_{40} = 8000 \cdot 0.338379 = 2707.03$$

$$B = S \cdot {}_{n}E_{x}$$

$${}_{n}E_{x} = \frac{D_{x+n}}{D_{x}}$$

Koliku jednokratnu premiju mora uplatiti osiguranik starosti 40 godina kako bi nakon navršene 65 godine raspolagao osiguranom svotom visine 8000 €?

Rješenje

$$_{25}E_{40} = \frac{D_{65}(m)}{D_{40}(m)} = \frac{8322.27}{24\,594.50} = 0.338379$$

$$B = S \cdot {}_{25}E_{40} = 8000 \cdot 0.338379 = 2707.03$$

Osiguranik mora uplatiti jednokratnu premiju visine 2707.03€.

drugi zadatak

Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} =$$

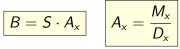
Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = ----$$

Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{}$$

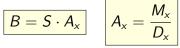
$$B = S \cdot A_x$$



Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07}$$

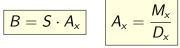
$$B = S \cdot A_x$$



Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07} = 0.352557$$

$$B = S \cdot A_x$$

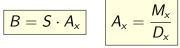


Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07} = 0.352557$$

$$B = S \cdot A_{50} =$$

$$B = S \cdot A_x$$

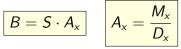


Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07} = 0.352557$$

$$B = S \cdot A_{50} = 20000$$

$$B = S \cdot A_x$$

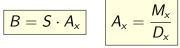


Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07} = 0.352557$$

$$B = S \cdot A_{50} = 20\,000 \cdot 0.352557$$

$$B = S \cdot A_x$$

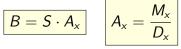


Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07} = 0.352557$$

$$B = S \cdot A_{50} = 20\,000 \cdot 0.352557 = 7051.14$$

$$B = S \cdot A_{x}$$



Koliku jednokratnu premiju mora uplatiti osiguranica starosti 50 godina kako bi u slučaju njezine smrti osiguravajuće društvo njezinoj obitelji isplatilo 20 000 €?

Riešenie

$$A_{50} = \frac{M_{50}(f)}{D_{50}(f)} = \frac{6146.51}{17434.07} = 0.352557$$

$$B = S \cdot A_{50} = 20\,000 \cdot 0.352557 = 7051.14$$

Osiguranica mora uplatiti jednokratnu premiju visine 7051.14€.

treći zadatak

Zadatak 3

Osiguranica starosti 35 godina uplati mješovito životno osiguranje s istekom osiguranja po navršenih 65 godina života. Osigurana svota iznosi 15 000 €.

- a) Koliku jednokratnu premiju mora uplatiti osiguranica?
- b) Ukoliko umjesto jednokratne premije osiguranica želi uplaćivati godišnje premije, kolika je visina godišnjih premija?

$$B = S \cdot A_{x:n}$$

 $A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$

$$A_{35:307} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$B = S \cdot A_{x:n}$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

 $B = S \cdot A_{x:n}$

$$\sum_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} = \frac{9662.06}{D_{35}(f)}$$

 $B = S \cdot A_{x:n}$

 $\sum_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$

$$A_{35:307} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84}{0}$$

 $B = S \cdot A_{x:n}$

 $\sum_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$

$$A_{35:30} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{200}$$

$$B = S \cdot A_{x:n}$$

$$D_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{29724.41}$$

$$B = S \cdot A_{x:n}$$

$$D_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$

$$B = S \cdot A_{x:n}$$

$$A_{x:n|} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30\rceil} = rac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= rac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$
 $B = S \cdot A_{35:30\rceil} =$

$$B = S \cdot A_{x:n}$$

$$A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30\rceil} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$

$$B = S \cdot A_{35:30\rceil} = 15000$$

$$B = S \cdot A_{x:n}$$

$$A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30]} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$

$$B = S \cdot A_{35:30} = 15000 \cdot 0.368216$$

$$B = S \cdot A_{x:n}$$

 $A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$

$$A_{35:30} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$

$$B = S \cdot A_{35:30} = 15000 \cdot 0.368216 = 5523.24$$

$$B = S \cdot A_{x:n}$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

a,

$$A_{35:30\rceil} = \frac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= \frac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$

$$B = S \cdot A_{35:30\rceil} = 15000 \cdot 0.368216 = 5523.24$$

Osiguranica mora uplatiti jednokratnu premiju visine 5523.24€.

$$B = S \cdot A_{x:n}$$

$$A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{35:30\rceil} = rac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= rac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$
 $B = S \cdot A_{35:30\rceil} = 15000 \cdot 0.368216 = 5523.24$

Osiguranica mora uplatiti jednokratnu premiju visine 5523.24€.

Interpretacija broja A_{35:301}

Riešenje

 $B = S \cdot A_{x:n}$ $A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$

$$A_{35:30\rceil} = rac{D_{65}(f) + M_{35}(f) - M_{65}(f)}{D_{35}(f)} =$$

$$= rac{9662.06 + 6515.84 - 5232.91}{29724.41} = 0.368216$$
 $B = S \cdot A_{35:30\rceil} = 15000 \cdot 0.368216 = 5523.24$

Osiguranica mora uplatiti jednokratnu premiju visine 5523.24€.

Interpretacija broja $A_{35\cdot 301}$

Uplati li osiguranica premiju visine 0.37€, u slučaju da u idućih 30 godina nastupi osigurani slučaj, obitelj ili ona sama će raspolagati osiguranom svotom visine $1 \in$. 12/22

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30\rceil} = rac{ extsf{N}_{35}(f) - extsf{N}_{65}(f)}{D_{35}(f)} =$$

$$B = S \cdot \frac{A_{\mathsf{x}:\mathsf{n}}}{\ddot{a}_{\mathsf{x}:\mathsf{n}}}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:307} = rac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:307} = rac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} = = rac{686\,310.58}{}$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{2000}$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:307} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41}$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{X:n}}{\ddot{a}_{X:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30]} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30]}}{\ddot{a}_{35:30]}} =$$

$$B = S \cdot \frac{A_{X:n}}{\ddot{a}_{X:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30}}{\ddot{a}_{35:30}} = 15000$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30]} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30}}{\ddot{a}_{35:30}} = 15\,000 \cdot ---$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30}}{\ddot{a}_{35:30}} = 15000 \cdot \frac{0.368216}{3000}$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30]} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30]}}{\ddot{a}_{35:30]}} = 15000 \cdot \frac{0.368216}{18.682774}$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30}}{\ddot{a}_{35:30}} = 15\,000 \cdot \frac{0.368216}{18.682774} = 295.63$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}} \qquad \qquad \ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:30} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30}}{\ddot{a}_{35:30}} = 15\,000 \cdot \frac{0.368216}{18.682774} = 295.63$$

Osiguranica mora tijekom 30 godina godišnje uplaćivati 295.63€.

$$B = S \cdot \frac{A_{x:n}}{\ddot{a}_{x:n}}$$

$$B = S \cdot \frac{A_{x:n]}}{\ddot{a}_{x:n]}} \qquad \qquad \ddot{a}_{x:n]} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{35:307} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30\rceil}}{\ddot{a}_{35:30\rceil}} = 15\,000 \cdot \frac{0.368216}{18.682774} = 295.63$$

Osiguranica mora tijekom 30 godina godišnje uplaćivati 295.63€.

Interpretacija broja ä_{35:301}

$$B = S \cdot \frac{\partial}{\partial x_{x,r}}$$

 $B = S \cdot \frac{A_{x:n]}}{\ddot{a}_{x:n]}} \qquad \begin{vmatrix} \ddot{a}_{x:n]} = \frac{N_x - N_{x+n}}{D} \end{vmatrix}$

$$\ddot{a}_{35:307} = \frac{N_{35}(f) - N_{65}(f)}{D_{35}(f)} =$$

$$= \frac{686310.58 - 130976.15}{29724.41} = 18.682774$$

$$B = S \cdot \frac{A_{35:30}}{\ddot{a}_{35:30}} = 15\,000 \cdot \frac{0.368216}{18.682774} = 295.63$$

Osiguranica mora tijekom 30 godina godišnje uplaćivati 295.63€.

Interpretacija broja ä_{35:301}

Uplati li osiguranica odmah 18.68€, idućih 30 godina može dobivati godišnje rente visine 1€.

četvrti zadatak

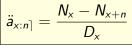
Zadatak 4

Osiguranik starosti 28 godina uplati mješovito životno osiguranje s istekom osiguranja po navršenih 65 godina života. Godišnja premija iznosi 5 000 kn, a osigurana svota je 250 000 kn.

- a) Izračunajte iznos premije privremene jedinične neodgođene osobne rente osiguranika i objasnite značenje dobivenog rezultata.
- b) Izračunajte iznos jednokratne premije mješovitog osiguranja za jediničnu osiguranu svotu i objasnite značenje dobivenog rezultata.
- c) Ako su zadani α i γ troškovi osiguranja $\alpha=0.032$ i $\gamma=0.0022$, izračunajte β troškove.
- d) Ukoliko osiguranik umjesto godišnjih premija odluči uplatiti jednokratnu premiju, koliko bi iznosila ta premija?

a)

$$\ddot{a}_{28:37\rceil} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} =$$



a)

$$\ddot{a}_{28:37} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} =$$

 $\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$

a)

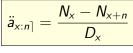
$$\ddot{a}_{28:37} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} =$$

$$= \frac{869668.78}{m}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

a)

$$\ddot{a}_{28:37} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} = \frac{869668.78 - 95725.33}{600}$$



Rješenje

a)

$$\ddot{a}_{28:37} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} = \frac{869688.78 - 95725.33}{37654.02}$$

Rješenje

a)

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{28:37} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} =$$

$$= \frac{869668.78 - 95725.33}{37654.02} = 20.554072$$

Rješenje

a)

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

$$\ddot{a}_{28:37} = \frac{N_{28}(m) - N_{65}(m)}{D_{28}(m)} =$$

$$= \frac{869668.78 - 95725.33}{37654.02} = 20.554072$$

Uplati li osiguranik odmah 20.55 kn, idućih 37 godina može dobivati godišnje rente visine 1 kn.

$$A_{28:37
ceil}=rac{D_{65}(m)+M_{28}(m)-M_{65}(m)}{D_{28}(m)}=$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$A_{28:37} = rac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} =$$

 $\mathbf{I}_{\mathbf{x}:n} = \frac{D_{\mathbf{x}+n} + M_{\mathbf{x}} - M_{\mathbf{x}+n}}{D_{\mathbf{x}}}$

$$A_{28:37} = \frac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} = \frac{8322.27}{28}$$

$$A_{28:37} = \frac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} =$$

$$= \frac{8322.27 + 8244.93}{2822.27 + 8244.93}$$

$$A_{28:37} = \frac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} = \frac{8322.27 + 8244.93 - 5085.18}{222.27 + 8244.93 - 5085.18}$$

$$A_{28:37} = \frac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} = \frac{8322.27 + 8244.93 - 5085.18}{37654.02}$$

$$A_{28:37} = \frac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} =$$

$$= \frac{8322.27 + 8244.93 - 5085.18}{37654.02} = 0.304935$$

b)

$$A_{28:37} = \frac{D_{65}(m) + M_{28}(m) - M_{65}(m)}{D_{28}(m)} =$$

$$= \frac{8322.27 + 8244.93 - 5085.18}{37654.02} = 0.304935$$

Uplati li osiguranik premiju visine 0.30 kn, u slučaju da u idućih 37 godina nastupi osigurani slučaj, obitelj ili on sam će raspolagati osiguranom svotom visine 1 kn.

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{28:37\rceil}^{a} = \frac{B}{S} =$$

 $B = S \cdot P_{x:n}^a$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = ---$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{}$$

$$B = S \cdot P_{x:n\rceil}^{a}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5\,000}{250\,000}$$

$$B = S \cdot P_{x:n]}^{a}$$

$$B = S \cdot P_{x:n]}^{a} = \frac{P_{x:n]}^{a} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37]}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$B = S \cdot P_{\mathbf{x}:n]}^{\mathbf{a}}$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = rac{A_{28:37]} + lpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-eta)\ddot{a}_{28:37]}}$$

$$B = S \cdot P_{x:n}^a$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{1}{5} = \frac{1}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1 - \beta)\ddot{a}_{28:37]}} / \cdot (1 - \beta)\ddot{a}_{28:37]}$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1 - \beta) \cdot \ddot{a}_{x:n}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$|F_{28:37}| = \frac{1}{5} = \frac{1}{250000} = 0.02$$

$$P^{a}_{28:37
ceil} = rac{A_{28:37
ceil} + lpha + \gamma \cdot \ddot{a}_{28:37
ceil}}{(1-eta)\ddot{a}_{28:37
ceil}} \ / \cdot (1-eta)\ddot{a}_{28:37
ceil}$$

$$P^{a}_{28:37\rceil} \cdot (1-\beta) \ddot{a}_{28:37\rceil} =$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1 - \beta) \cdot \ddot{a}_{x:n}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5\,000}{250\,000} = 0.02$$

$$P_{28:37]}^{a} = rac{A_{28:37]} + lpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-eta)\ddot{a}_{28:37]}} \left/ \cdot (1-eta)\ddot{a}_{28:37]} \right.$$

$$\beta \hat{a}_{29.271} = A_{29.271} + \alpha + \gamma \cdot \hat{a}_{29.271}$$

$$P_{28:37]}^{\mathsf{a}} \cdot (1-\beta)\ddot{\mathsf{a}}_{28:37]} = A_{28:37]} + \alpha + \gamma \cdot \ddot{\mathsf{a}}_{28:37]}$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1 - \beta) \cdot \ddot{a}_{x:n}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]}^{a} \cdot (1-\beta)\ddot{a}_{28:37]} = A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} / : P_{28:37]}^{a} \ddot{a}_{28:37]}$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]}^{a} = \frac{12037 + 177}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]}^{a} \cdot (1-\beta)\ddot{a}_{28:37]} = A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} / : P_{28:37]}^{a} \ddot{a}_{28:37]}$$

$$1-\beta =$$

$$B = S \cdot P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$B = 5000$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]} = \frac{1}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]}^{a} \cdot (1-\beta)\ddot{a}_{28:37]} = A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} / : P_{28:37]}^{a} \ddot{a}_{28:37]}$$

$$1-\beta =$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]}^{a} = \frac{1}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P_{28:37]}^{a} \cdot (1-\beta)\ddot{a}_{28:37]} = A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} / : P_{28:37]}^{a} \ddot{a}_{28:37]}$$

$$1-eta=rac{ extsf{A}_{28:37]}+lpha+\gamma\cdot\ddot{ extsf{a}}_{28:37]}{ extsf{A}}$$

$$B = S \cdot P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$B = S \cdot P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37\rceil}^{a} = \frac{A_{28:37\rceil} + \alpha + \gamma \cdot \ddot{a}_{28:37\rceil}}{(1-\beta)\ddot{a}_{28:37\rceil}} / \cdot (1-\beta)\ddot{a}_{28:37\rceil}$$

$$-\beta =$$

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$$B = S \cdot P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$egin{align*} P_{28:37
ceil}^{ extstyle a} \cdot (1-eta)\ddot{ extstyle a}_{28:37
ceil} &= A_{28:37
ceil} + lpha + \gamma \cdot \ddot{ extstyle a}_{28:37
ceil} & \Big/: P_{28:37
ceil}^{ extstyle a} \ddot{ extstyle a}_{28:37
ceil} \ & 1-eta &= rac{A_{28:37
ceil} + lpha + \gamma \cdot \ddot{ extstyle a}_{28:37
ceil}}{P_{28:37
ceil}^{ extstyle a} \ddot{ extstyle a}_{28:37
ceil}} \end{split}$$

$$-\beta = -1$$

$$B = S \cdot P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{28:37}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$$

$$P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$\begin{aligned} P_{28:37]}^{a} \cdot (1 - \beta) \ddot{a}_{28:37]} &= A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} \ / : P_{28:37]}^{a} \ddot{a}_{28:37]} \\ 1 - \beta &= \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}} \end{aligned}$$

$$-\beta = -1 + \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$= \frac{B}{A_{x:n}} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1 - \beta) \cdot \ddot{a}_{x:n}}$$

$$P^{a}_{28:37]} = \frac{B}{S} = \frac{5\,000}{250\,000} = 0.02$$

$$P^{a}_{28:37]} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1-\beta)\ddot{a}_{28:37]}} / \cdot (1-\beta)\ddot{a}_{28:37]}$$

$$P^{a}_{28:37]} \cdot (1-\beta)\ddot{a}_{28:37]} = A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} / : P^{a}_{28:37]}\ddot{a}_{28:37]}$$

$$1 - \beta = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P^{a}_{28:37]}\ddot{a}_{28:37]}}$$

$$-\beta = -1 + \frac{A_{28:37]} a_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}} / \cdot (-1)$$

 $B = S \cdot P_{x:n]}^{a} \qquad P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$ $P_{28:37]}^{a} = \frac{B}{S} = \frac{5000}{250000} = 0.02$

 $P_{28:37]}^{a} = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{(1 - \beta)\ddot{a}_{28:37]}} / \cdot (1 - \beta)\ddot{a}_{28:37]}$

$$P^{a}_{28:37
ceil} \cdot (1-eta)\ddot{a}_{28:37
ceil} = A_{28:37
ceil} + lpha + \gamma \cdot \ddot{a}_{28:37
ceil} \ /: P^{a}_{28:37
ceil} \ddot{a}_{28:37
ceil}$$

$$\frac{1}{|a_{37}|} + \alpha + \gamma \cdot \ddot{a}_{28:37}$$
 $\frac{1}{|a_{28:37}|}$
 $\frac{1}{|a_{28:37}|}$

$$1 - \beta = \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]} / (13)$$

$$egin{align} I - eta &= rac{P_{28:37|}^a \ddot{a}_{28:37|}}{P_{28:37|}^a + lpha + \gamma \cdot \ddot{a}_{28:37|}} \ -eta &= -1 + rac{A_{28:37|} + lpha + \gamma \cdot \ddot{a}_{28:37|}}{P_{28}^a + \ddot{a}_{28:37|}} \ igg/ \cdot (-1) \ \end{array}$$

$$-eta = -1 + rac{m{\mathcal{A}}_{28:37
ceil} + lpha + \gamma \cdot \ddot{m{a}}_{28:37
ceil}}{m{\mathcal{P}}_{28:37
ceil}^{m{a}} \ddot{m{a}}_{28:37
ceil}} \ igg/ \cdot (-1)$$

$$-eta = -1 + rac{{{A_{28:37\rceil}} + lpha + \gamma \cdot \ddot{a}_{28:37\rceil}}{{P_{28:37\rceil}^{\sf a}\ddot{a}_{28:37\rceil}}} \ igg/ \cdot (-1)$$

 $eta = 1 - rac{A_{28:37]} + lpha + \gamma \cdot \ddot{a}_{28:37]}}{P^{ extbf{a}}_{28:37]} \ddot{a}_{28:37]}}$ 17/22

$$\beta = 1 - \frac{\textit{A}_{\text{28:37}} + \alpha + \gamma \cdot \ddot{\textit{a}}_{\text{28:37}}}{\textit{P}_{\text{28:37}}^{\textit{a}} \ddot{\textit{a}}_{\text{28:37}}}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 -$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935}{}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.004935}{0.004935}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.032}{}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{A_{28:37\rceil} + \alpha + \gamma \cdot \ddot{a}_{28:37\rceil}}{P^{a}_{28:37\rceil} \ddot{a}_{28:37\rceil}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022}{}$$

$$\beta = 1 - \frac{\textit{A}_{28:37\rceil} + \alpha + \gamma \cdot \ddot{\textit{a}}_{28:37\rceil}}{\textit{P}_{28:37\rceil}^{\textit{a}} \ddot{\textit{a}}_{28:37\rceil}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot}{}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P^{a}_{28:37]} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.0022 \cdot 20.554072}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P^{a}_{28:37]} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P^{a}_{28:37]} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P^{a}_{28:37]} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

$$\beta = 1 - \frac{A_{28:37} + \alpha + \gamma \cdot \ddot{a}_{28:37}}{P_{28:37}^{a} \ddot{a}_{28:37}}$$
$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

$$\beta = 0.070369$$

$$A_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{1 - \beta}$$

d)

$$B' = S \cdot A_{x:n}^a$$

$$eta = 1 - rac{A_{28:37
ceil} + lpha + \gamma \cdot \ddot{a}_{28:37
ceil}}{P^{\it a}_{28:37
ceil} \ddot{a}_{28:37
ceil}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

$$\beta = 0.070369$$

$$B = S \cdot P_{x:n|}^{a}$$

$$A_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{1 - \beta}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{P_{28:37]}^{a} \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

 $P_{\mathbf{x}:\mathbf{n}|}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}|} + \alpha + \gamma \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}|}}{(1 - \beta) \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}|}}$

$$\beta=0.070369$$

$$B = S \cdot P_{x:n}^a$$

$$B' = S \cdot A_{x:n}^{a}$$

$$A_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{1 - \beta}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\beta = 1 - \frac{1 - \frac{1 \cdot 20.37 + 3 \cdot 1 \cdot 7 \cdot 320.37 + 320.37$$

 $P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$

$$eta=0.070369$$

$$B = S \cdot P_{x:n}^{a}$$

$$B' = S \cdot A_{x:n}^{a}$$

d)
$$B' = B \cdot \ddot{a}_{22,27} = 5000$$

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$$A_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{1 - \beta}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

 $P_{\mathbf{x}:\mathbf{n}}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}} + \alpha + \gamma \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}}}{(1-\beta) \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}}}$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

$$\beta=0.070369$$

$$B = S \cdot P_{x:n}^{a}$$

$$B' = S \cdot A_{x:n}^{a}$$

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d)
$$B' = B \cdot \ddot{a}_{28:37} = 5\,000 \cdot 20.554072$$

$$A_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{1 - \beta}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

 $P_{\mathbf{x}:\mathbf{n}}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}} + \alpha + \gamma \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}}}{(1-\beta) \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}}}$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

$$\beta = 0.070369$$

$$B = S \cdot P_{x:n]}^{a}$$

$$B' = S \cdot A_{x:n}^{a}$$

$$B' = B \cdot \ddot{a}_{28:37} = 5\,000 \cdot 20.554072 = 102\,770.36$$

$$D = D \cdot a_{28:37} = 3\,000 \cdot 20.334072 = 102\,770.30$$

$$A_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{1 - \beta}$$

$$\beta = 1 - \frac{A_{28:37]} + \alpha + \gamma \cdot \ddot{a}_{28:37]}}{P_{28:37]}^{a} \ddot{a}_{28:37]}}$$

$$\frac{0022 \cdot 20.554072}{4072}$$

$$B = S \cdot P_{x:n}^{a}$$

 $B' = S \cdot A_{x:n}^a$

 $P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1-\beta) \cdot \ddot{a}_{x:n}}$

$$\beta = 1 - \frac{0.304935 + 0.032 + 0.0022 \cdot 20.554072}{0.02 \cdot 20.554072}$$

 $\beta = 0.070369$

$$B' = B \cdot \ddot{a}_{28:37} = 5\,000 \cdot 20.554072 = 102\,770.36$$

peti zadatak

Zadatak 5

Osiguranica starosti 42 godine uplati mješovito životno osiguranje s istekom osiguranja nakon navršenih 65 godina života. Godišnja premija iznosi 3 050 kn, a osigurana svota 74 500 kn.

- a) Ako su β i γ troškovi osiguranja $\beta=0.03$ i $\gamma=0.004$, izračunajte α troškove.
- b) Ako se svi troškovi udvostruče, koliko bi uz trostruko veću osiguranu svotu iznosila godišnja premija?
- c) Koliko iznosi premija koju osiguranica mora uplatiti odmah da bi iduće 23 godine mogla dobivati osobnu rentu visine godišnje premije mješovitog osiguranja?

a d

 $B = S \cdot P_{x:n\rceil}^a$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{B}{S}$$

 $B = S \cdot P_{x:n}^a$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{B}{S} = ---$$

 $B = S \cdot P_{x:n\rceil}^a$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{B}{S} = \frac{3050}{}$$

 $B = S \cdot P_{x:n}^{a}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500}$$

 $B = S \cdot P_{x:n}^a$

$$P_{\mathbf{x}:\mathbf{n}}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}} + \alpha + \gamma \cdot \ddot{a}_{\mathbf{x}:\mathbf{n}}}{(1 - \beta) \cdot \ddot{a}_{\mathbf{x}:\mathbf{n}}}$$

$$P_{42:23\rceil}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

 $B = S \cdot P_{x:n}^a$

$$P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1-\beta) \cdot \ddot{a}_{x:n}}$$

$$P_{42:23\rceil}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$
$$\ddot{a}_{42:23\rceil} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D}$$

 $B = S \cdot P_{x:n}^a$

 $P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot \ddot{a}_{x:n}}{(1-\beta) \cdot \ddot{a}_{x:n}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$P_{42:23]}^{8} = \frac{1}{S} = \frac{1}{74500} = 0.040940$$

$$\ddot{a}_{42:23]} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{1}{3}$$

$$N_{x+n}$$

 $B = S \cdot P_{x:n}^a$

 $P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$

$$P_{42:23]}^{a} = \frac{B}{S} = \frac{3\,050}{74\,500} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498\,504.41}{665}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

 $B = S \cdot P_{x:n}^a$

 $P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498504.41 - 1000}{1000}$$

$$\ddot{a}_{x:n} = \frac{N_x - N_{x+n}}{D_x}$$

 $B = S \cdot P_{x:n}^a$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\ddot{a}_{42:23\rceil} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498\,504.41 - 130\,976.15}{120\,976.15}$$

 $B = S \cdot P_{x:n}^a$

 $P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$

$$P_{42:23\rceil}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\ddot{a}_{42:23|} = \frac{1}{S} - \frac{74500}{74500} = \frac{498504.41 - 130976.15}{23253.48}$$

$$\frac{04.41 - 130\,976.15}{23\,253.48}$$

$$B = S \cdot P_{x:n\rceil}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{B}{S} = \frac{3\,050}{74\,500} = 0.040940$$

$$S = 74500$$

... $N_{42}(f) - N_{65}(f) = 4981$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498504.41 - 130976.15}{23253.48} = 15.805301$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

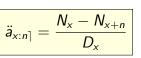
$$\frac{60}{00} = 0.040940$$

$$\frac{1}{74\,500} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498504.41 - 130976.15}{23253.48} = 15.805301$$

$$A_{42:237} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)}$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$



$$B = S \cdot P_{x:n]}^{a}$$

 $P_{\mathbf{x}:\mathbf{n}}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}} + \alpha + \gamma \cdot \mathbf{a}_{\mathbf{x}:\mathbf{n}}}{(1-\beta) \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\frac{0}{00} = 0.040940$$

$$= 0.040940$$

$$\frac{04.41 - 130\,976}{23\,253\,49}$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498\,504.41 - 130\,976.15}{23\,253.48} = 15.805301$$

$$M_{65}(f)$$

$$I_{65}(f)$$

$$A_{42:237} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$A_{x:n]} = rac{D_{x+n} + M_x - M_{x+n}}{D_x}$$
 $\ddot{a}_{x:n]} = rac{N_x - N_{x+n}}{D_x}$

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 $B = S \cdot P_{x:n}^a$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

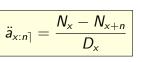
$$P_{42:23\rceil}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$-\frac{1}{S} - \frac{74500}{74500} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498504.41 - 130976.15}{23253.48} = 15.805301$$

$$A_{42:237} = rac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$A_{x:n]} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$



 $B = S \cdot P_{x:n}^{a}$

 $P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\frac{0}{00} = 0.040940$$

$$V_{42:23} = \frac{1}{S} = \frac{1}{74500} = 0.040940$$

$$\ddot{a}_{42:23\rceil} = \frac{\textit{N}_{42}(f) - \textit{N}_{65}(f)}{\textit{D}_{42}(f)} = \frac{498\,504.41 - 130\,976.15}{23\,253.48} = 15.805301$$

$$A_{42:237} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

9662.06 +

$$M_{65}(f)$$

$$A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$\ddot{a}_{x:n]} = \frac{N_x - N_{x+n}}{D_x}$$

$$B = S \cdot P_{x:n}^a$$

 $P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$

$$B^{3} = B = 3050 = 0.040040$$

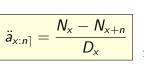
$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498504.41 - 130976.15}{23253.48} = 15.805301$$

$$A_{42:23} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$A_{42:23} = \frac{-33(7) + 442(7) + 433(7)}{D_{42}(f)} = \frac{9662.06 + 6395.84}{2}$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$



$$B = S \cdot P_{x:n}^a$$

 $P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\ddot{a}_{42:23\rceil} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498\,504.41 - 130\,976.15}{23\,253.48} = 15.805301$$

$$A_{42:237} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$9\,662.06 + 6\,395.84 -$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\frac{050}{500} = 0.040940$$

$$\frac{6}{00} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498\,504.41 - 130\,976.15}{23\,253.48} = 15.805301$$

$$M_{65}(f)$$

$$I_{65}(f)$$

$$A_{42:23\rceil} = rac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$9662.06 + 6395.84 - 5232.91$$

$$A_{x:n\rceil} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

$$\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D_x}$$

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 $B = S \cdot P_{x:n}^{a}$

 $P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$P_{42:23}^{a} = \frac{1}{S} = \frac{1}{74500} = 0.040940$$

$$\ddot{a}_{42:23} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498504.41 - 130976.15}{23253.48} = 15.805301$$

$$A_{42:237} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$9.662.06 + 6.395.84 - 5.232.93$$

$$=\frac{9662.06+6395.84-5232.91}{23253.48}$$

$$A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

 $\ddot{a}_{x:n\rceil} = \frac{N_x - N_{x+n}}{D}$

20/22

 $B = S \cdot P_{x:n}^a$

 $P_{\mathbf{x}:\mathbf{n}}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}} + \alpha + \gamma \cdot \mathbf{a}_{\mathbf{x}:\mathbf{n}}}{(1-\beta) \cdot \ddot{\mathbf{a}}_{\mathbf{x}:\mathbf{n}}}$

$$P_{42:23}^{a} = \frac{B}{S} = \frac{3050}{74500} = 0.040940$$

$$\frac{60}{00} = 0.040940$$

$$\ddot{a}_{42:23\rceil} = \frac{N_{42}(f) - N_{65}(f)}{D_{42}(f)} = \frac{498\,504.41 - 130\,976.15}{23\,253.48} = 15.805301$$

$$= 15.805301$$

$$A_{42:23\rceil} = \frac{D_{65}(f) + M_{42}(f) - M_{65}(f)}{D_{42}(f)} =$$

$$\frac{9662.06 + 6395.84 - 5232.91}{23253.48} = 0.465521$$

$$A_{x:n} = \frac{D_{x+n} + M_x - M_{x+n}}{D_x}$$

23 253.48

$$\frac{+n}{\ddot{a}_{x:n}} = \frac{N_x - N_{x+n}}{D_x}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{\mathsf{a}} \cdot (1-\beta) \ddot{\mathsf{a}}_{42:23\rceil} =$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23]}^{a} \cdot (1-\beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{s} \cdot (1-\beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha =$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$\begin{aligned} P_{42:23\rceil}^{a} &= \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - \beta)\ddot{a}_{42:23\rceil}} \left/ \cdot (1 - \beta)\ddot{a}_{42:23\rceil} \right. \\ \\ P_{42:23\rceil}^{a} \cdot (1 - \beta)\ddot{a}_{42:23\rceil} &= A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil} \end{aligned}$$

$$-\alpha = A_{42:23} + \gamma \cdot \ddot{a}_{42:23}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$\begin{split} P^{\mathsf{a}}_{42:23\rceil} &= \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} \ \bigg/ \cdot (1-\beta)\ddot{a}_{42:23\rceil} \\ P^{\mathsf{a}}_{42:23\rceil} \cdot (1-\beta)\ddot{a}_{42:23\rceil} &= A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil} \\ -\alpha &= A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P^{\mathsf{a}}_{42:23\rceil} \cdot (1-\beta)\ddot{a}_{42:23\rceil} \ \bigg/ \cdot (-1) \end{split}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha =$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$\alpha =$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha = A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} / \cdot (-1)$$

$$\alpha = P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} - A_{42:23\rceil} - \gamma \cdot \ddot{a}_{42:23\rceil}$$

 $\alpha = 0.040940$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$\alpha = 0.040940 \cdot$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha = A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} / \cdot (-1)$$

$$\alpha = P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} - A_{42:23\rceil} - \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$\alpha = 0.040940 \cdot (1-0.03)$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$\alpha = 0.040940 \cdot (1 - 0.03) \cdot$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - \beta)\ddot{a}_{42:23\rceil}} / \cdot (1 - \beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{a} \cdot (1 - \beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha = A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P_{42:23\rceil}^{a} \cdot (1 - \beta)\ddot{a}_{42:23\rceil} / \cdot (-1)$$

$$\alpha = P_{42:23\rceil}^{a} \cdot (1 - \beta)\ddot{a}_{42:23\rceil} - A_{42:23\rceil} - \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301 -$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha = A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} / \cdot (-1)$$

$$\alpha = P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} - A_{42:23\rceil} - \gamma \cdot \ddot{a}_{42:23\rceil}$$

 $\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301 - 0.465521$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1-\beta)\ddot{a}_{42:23\rceil}} / \cdot (1-\beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha = A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} / \cdot (-1)$$

$$\alpha = P_{42:23\rceil}^{a} \cdot (1-\beta)\ddot{a}_{42:23\rceil} - A_{42:23\rceil} - \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$\alpha = 0.040940 \cdot (1-0.03) \cdot 15.805301 - 0.465521 -$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301 - 0.465521 - 0.004$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1-\beta)\ddot{a}_{42:23]}} / \cdot (1-\beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1-\beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1-\beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1-\beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

 $\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301 - 0.465521 - 0.004 \cdot$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}}{(1 - \beta)\ddot{a}_{42:23]}} / \cdot (1 - \beta)\ddot{a}_{42:23]}$$

$$P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} = A_{42:23]} + \alpha + \gamma \cdot \ddot{a}_{42:23]}$$

$$-\alpha = A_{42:23]} + \gamma \cdot \ddot{a}_{42:23]} - P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} / \cdot (-1)$$

$$\alpha = P_{42:23]}^{a} \cdot (1 - \beta)\ddot{a}_{42:23]} - A_{42:23]} - \gamma \cdot \ddot{a}_{42:23]}$$

$$\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301 - 0.465521 - 0.004 \cdot 15.805301$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - \beta)\ddot{a}_{42:23\rceil}} / \cdot (1 - \beta)\ddot{a}_{42:23\rceil}$$

$$P_{42:23\rceil}^{a} \cdot (1 - \beta)\ddot{a}_{42:23\rceil} = A_{42:23\rceil} + \alpha + \gamma \cdot \ddot{a}_{42:23\rceil}$$

$$-\alpha = A_{42:23\rceil} + \gamma \cdot \ddot{a}_{42:23\rceil} - P_{42:23\rceil}^{a} \cdot (1 - \beta)\ddot{a}_{42:23\rceil} / \cdot (-1)$$

$$lpha = P_{ exttt{42:23}}^{ exttt{a}} \cdot (1-eta) \ddot{ exttt{a}}_{ exttt{42:23}} - A_{ exttt{42:23}} - \gamma \cdot \ddot{ exttt{a}}_{ exttt{42:23}}$$

$$\alpha = 0.040940 \cdot (1 - 0.03) \cdot 15.805301 - 0.465521 - 0.004 \cdot 15.805301$$

$$\alpha = 0.098915$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

b)
$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} =$$

$$2\alpha + 2\gamma \cdot \ddot{a}_{42,22}$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$\frac{+2\alpha + 2\gamma \cdot \ddot{a}_{42:23}}{-2\beta)\ddot{a}_{42:23}} =$$

$$B = S \cdot P_{x:n}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} =$$

$$= \frac{0.465521 + }{}$$

$$B = S \cdot P^a_{x:n \rceil}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} = \frac{0.465521 + 2 \cdot 0.098915}{}$$

$$B = S \cdot P^a_{x:n \rceil}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} = \frac{0.465521 + 2 \cdot 0.098915 + 2}{1 + 2}$$

$$B = S \cdot P^a_{x:n \rceil}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = rac{A_{42:23\rceil} + 2lpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2eta)\ddot{a}_{42:23\rceil}} = rac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004}{(1 - 2eta)\ddot{a}_{42:23}}$$

$$B = S \cdot P_{x:n\rceil}^{a}$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 0}{(1 - 2\beta)\ddot{a}_{42:23}}$$

$$B = S \cdot P_{x:n\rceil}^a$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2\beta)\ddot{a}_{42:23}}$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$\begin{split} P_{42:23\rceil}^{a} &= \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} = \\ &= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03)} \end{split}$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$\begin{aligned} P_{42:23\rceil}^{a} &= \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} = \\ &= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03)} \end{aligned}$$

$$B = S \cdot P_{x:n}^{a}$$

 $P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$

$$\begin{split} P_{42:23\rceil}^{a} &= \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} = \\ &= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} \end{split}$$

$$B = S \cdot P^a_{x:n\rceil}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

b)

$$P_{42:23\rceil}^{a} = \frac{742:23\rceil + 24 + 2\gamma - 442:23\rceil}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$= \frac{(1-2\beta)\ddot{a}_{42:23\rceil}}{(1-2\beta)3\ddot{a}_{42:23\rceil}} = \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1-2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23}^a =$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23}^{a} = 3 \cdot 74\,500$$

$$B = S \cdot P_{x:n\rceil}^a$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23|}^{a} = 3 \cdot 74\,500 \cdot$$

$$B = S \cdot P_{x:n\rceil}^a$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$\begin{split} P^{s}_{42:23\rceil} &= \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} = \\ &= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} = \end{split}$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23}^{a} = 3 \cdot 74\,500 \cdot 0.053160$$

$$B = S \cdot P_{x:n]}^{a}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1 - \beta) \cdot \ddot{a}_{x:n\rceil}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$$

$$B = S \cdot P_{x:n\rceil}^{a}$$

$$P_{x:n\rceil}^{a} = \frac{A_{x:n\rceil} + \alpha + \gamma \cdot \ddot{a}_{x:n\rceil}}{(1-\beta) \cdot \ddot{a}_{x:n\rceil}}$$

b)

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

 $B = 3S \cdot P_{42 \cdot 237}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$

$$B = S \cdot \ddot{a}_{42:23} =$$

$$B = S \cdot P_{x:n}^a$$

$$P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

 $B = 3S \cdot P_{42 \cdot 237}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$

$$B = S \cdot \ddot{a}_{42:23} = 3\,050$$

$$B = S \cdot P_{x:n}^a$$

 $P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot \ddot{a}_{x:n]}}{(1-\beta) \cdot \ddot{a}_{x:n]}}$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42:23}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$$

$$B = S \cdot \ddot{a}_{42:23} = 3\,050 \cdot$$

$$B = S \cdot P_{x:n}^a$$

 $P_{\mathbf{x}:\mathbf{n}}^{\mathbf{a}} = \frac{A_{\mathbf{x}:\mathbf{n}} + \alpha + \gamma \cdot \ddot{a}_{\mathbf{x}:\mathbf{n}}}{(1-\beta) \cdot \ddot{a}_{\mathbf{x}:\mathbf{n}}}$

$$P_{42:23\rceil}^{a}=rac{A_{42}}{}$$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

 $B = 3S \cdot P_{42 \cdot 237}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$

$$= 0.053160$$

b)

$$B = S \cdot \ddot{a}_{42:23} = 3\,050 \cdot 15.805301$$

$$B = S \cdot P_{x:n}^a$$

 $P_{x:n]}^{a} = \frac{A_{x:n]} + \alpha + \gamma \cdot a_{x:n]}}{(1 - \beta) \cdot \ddot{a}_{x:n]}}$

$$P_{42:23]}^{a} = \frac{A_{42:23]} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23]}}{(1 - 2\beta)\ddot{a}_{42:23]}} =$$

$$= \frac{0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301}{(1 - 2 \cdot 0.03) \cdot 15.805301} =$$

$$= 0.053160$$

$$B = 3S \cdot P_{42\cdot23}^{a} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$$

Godišnja premija iznosila bi 11 881.26 kn.

 $B = S \cdot \ddot{a}_{42:23} = 3\,050 \cdot 15.805301 = 48\,206.17$

 $B = S \cdot P_{x:n}^{a}$

 $0.465521 + 2 \cdot 0.098915 + 2 \cdot 0.004 \cdot 15.805301$ $(1-2\cdot 0.03)\cdot 15.805301$

 $P_{x:n}^{a} = \frac{A_{x:n} + \alpha + \gamma \cdot a_{x:n}}{(1-\beta) \cdot \ddot{a}_{x:n}}$ $P_{42:23\rceil}^{a} = \frac{A_{42:23\rceil} + 2\alpha + 2\gamma \cdot \ddot{a}_{42:23\rceil}}{(1 - 2\beta)\ddot{a}_{42:23\rceil}} =$

$$B = 3S \cdot P^a_{42:23\rceil} = 3 \cdot 74\,500 \cdot 0.053160 = 11\,881.26$$
 Godišnja premija iznosila bi 11\,881.26 kn.

= 0.053160

c)

b)

 $B = S \cdot \ddot{a}_{42:23} = 3\,050 \cdot 15.805301 = 48\,206.17$

Osiguranica bi morala odmah uplatiti premiju visine 48 206.17 kn.