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SRM Assignment

Q1

	DY			
AY	0	1	2	3
2001	1276.11	1002.9	605.15	356
2002	1460.68	1079.30	723	
2003	1554.46	1079		
2004	1491			

Cumulative claim mid 2004 prices

	DY			
AY	0	1	2	3
01	1276.11	2279.01	2884.13	3240.13
02	1460.68	2539.98	3262.98	
03	1554.46	2633.46		
04	1491			

Total claims	5782.25	7452.45	6147.11	3240.13
- last claim	1491	2633.46	3262.65	0
	4291.25	4818.99	2884.13	3240.23

Development factors	1.736	1.2756	1.153

	DY			
AY	0	1	2	3
01	1276.11	2279.01	2884.13	3240.13
02	1460.68	2539.98	3262.98	3665.74
03	1554.46	2633.46	3359.25	6773.89
04	1491	2589.36	3302.99	3710.69

Incremental claims

	0	1	2	3
2004		1098.36	712.64	407.7
Inflation		× 1.025	× 1.050625	× 1.076891
		1125.819	748.72	439.05

Total Claims = 2313.588

(ii) Ultimate amount for 2004 policies = 5250000 × 0.75
= 3937500

f	-	2.48871	1.43304	1.12343
Reverse	1	1.2343	1.43304	2.48871
1/f	1	0.81017	0.6978	0.4018
1 - 1/f	0	0.18983	0.3022	0.5982

For AY2004

DY EL

1 $3937.5 \times \left(\frac{1}{1.43304} - \frac{1}{2.4887} \right) = 1165.51 \times 1.025 = 1194.65$

2 $3937.5 \left(\frac{1}{1.2643} - \frac{1}{1.433} \right) = 757.24 \times 1.050625 = 795.57$

3 $3937.5 \left(1 - \frac{1}{1.2243} \right) = 432.61 \times 1.0769 = 465.87$

∴ Total EL = 2456.09

Q2

	1	2	3	Ultimate
2005	3512	7210	9563	9563
2006	2889			
2007	3876			

λ	2.1767	1.3264	1
f	2.8872	1.3264	1
$1-\frac{1}{f}$	0.6536	0.24608	0

AY	2007	2006	2005
EP	12549	11314	11041
IUL	10917.63	9843.18	9605.67
EL	7135.76	2422.21	0
RL	3870	6723	9563
UL	11005.76.	9145.21	9563

$\therefore$ Total UL = 29713.97 ×1000

$\therefore$ Reserves = 29713970 − 20103000

= 9610970

Q3 Incremental data - Mid 2013 prices

	DY			
AY	0	1	2	3
2010	~~124 × 111/100~~ = 137.64	36.288	31.5688	13
2011	101.39	28.514	23	
2012	129.33	35		
2013	149			

Cumulative claims

	DY.			
AY	0	1	2	3
10	137.64	173.928	205.4968	218.4968
11	101.39	129.904	152.904	
12	129.33	164.33		
13	149			

Development factors	1.27097	1.17960	1.06326
	(A)	(B)	(C)

Predicting future values

	DY			
AY	0	1	2	3
10				162.577
11			193.844	206.11
12		189.37	223.38	237.512
13				

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Incremental claims (without inflation)

AY	DY 0	1	2	3
10				
11				9.673
12			29.514	12.266
13		40.37	34.01	14.132

1yr

2yrs

3yrs

Incremental (with inflation)

AY	DY 0	1	2	3
10				
11				9.9632
12			30.399	13.013
13		41.5811	36.081	15.442

∴ O/s claims with inflation = 9.9632 + 30.399 + . . . +

. . + 15.442

= 146.4793

Q4

(i) ~~Exce~~

ACPC table

AY	DY 0	1	2	Ultimate
05	530.634	720.744	830.532	830.532
06	491.320	716.092		825.1714
07	753.836			1221.4595

Ultimate values for claim nos

AY	DY 0	1	2	Ultimate
05	88	121	156	156
06	128	163		210.15
07	98			172.7237

AY	ACPC × No. of claims	=	Projected
2006	825.1714 × 210.149		= 173408.95
2007	1221.4595 × 172.7237		= 210975.004
2008	880.532 × 156		= 129562.99

Total = 173408.9445
210925.004
129562.99
―――――――
513946.9407

∴ o/s claims = 513946.9407 − (73876 + 116723 + 129563)

= 193784.9384

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Q5 $X \sim exp(\lambda)$

S.T ; $Y = KX \sim exp$

$$P(Y < y) = P(KX < y)$$
$$= P(X < y/k)$$
$$= \int_0^{y/k} \lambda e^{-\lambda z} . dz = \int_0^{y} \lambda e^{\lambda/k \, x} . \frac{dx}{k}$$
$$= \int_0^{y} \frac{\lambda}{k} e^{\lambda/k \, x} . dx$$

This is a function of exp distⁿ with para λ/k

(ii) likelihood of data is:

$$L = C \times e^{-4\lambda M} \times \prod_i (\lambda e^{-\lambda x_i}) \, e^{-6\lambda M/k} \times \prod_j (\lambda/k \, e^{-\lambda y_j/k})$$

log likelihood

$$l = \ln L = C' - 4\lambda M + 10 \ln \lambda - \lambda \Sigma x_i - 6\lambda M/k + 12 \ln \lambda - \lambda/k \, \Sigma y_i$$
$$= C' - 4\lambda M + 22 \ln \lambda - 13500 \lambda - 6\lambda M/k - 17000 \lambda/k$$

$$l' = -4M + \frac{22}{\lambda} - 13500 - 6 M/k - 17000/k$$

$$l' = 0$$

$\therefore -4M + 22/\lambda - 13500 - 6M/k - 17000/k = 0$

$$22/\hat{\lambda} = 13500 + 17000/k + 4M + 6M/k$$

$$\hat{\lambda} = \frac{22}{13500 + 17000/k + 4M + 6M/k}$$

$$l'' = \frac{-22}{\lambda^2} < 0$$

(iii) (a) $\hat{\lambda} = \dfrac{22}{13500 + 17000/1.1 + 4 \times 1600 + 6 \times 1600/1.1}$

$= 0.000499$

(b) $E(\text{payment / claim for } 2006) =$

$\int_0^M x \lambda e^{-\lambda x} \, dx + M \int_M^\infty \lambda e^{-\lambda x} \, dx = \left[-x e^{-\lambda x}\right]_0^M + \int_0^M e^{-\lambda x} \, dx + M \left[-e^{-\lambda x}\right]_M^\infty$

$= -Me^{-\lambda M} + \left[-\frac{1}{\lambda} e^{-\lambda x}\right]_0^M + Me^{-\lambda M}$

$= \frac{1}{\lambda}\left(1 - e^{-\lambda M}\right)$

$= \frac{1}{0.000499}\left(1 - e^{-0.000499 \times 1600}\right)$

$= 1102.107$

$1102.107 = \int_0^R x \mu e^{-\mu x} \, dx + R \int_R^\infty \mu e^{-\mu x} \, dx$

$= \frac{1}{\mu}\left(1 - e^{-\mu R}\right) = \frac{1.05 \times 1.1}{0.0004999}\left(1 - e^{\frac{0.000499R}{1.05 \times 1.1}}\right)$

$0.476148392 = 1 - e^{-0.00043203463R}$

$\therefore R = -\frac{1}{0.00043203462} \log(1 - 0.476148392)$

$= 1496.52$

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Q7 Claims $\sim$ Poi (50)

$\therefore$ Claim amt $=$ 100 X

$f(x) = \frac{3}{32}(6x - x^2 - 5)$

(i) $E(100X) = 100 E(X)$

$= 100 \times \frac{3}{32} \int_1^5 x(6x - x^2 - 5) \cdot dx$

$= 100 \times \frac{3}{32} \times \int_1^5 6x^2 - x^3 - 5x \cdot dx$

$= 300/32 \left[2x^3 - \frac{x^4}{4} - \frac{5x^2}{2}\right]_1^5$

$= \frac{300}{32}[31.25 + 0.75] = 300$

$var(100X) = E(100X)^2 - [E(100X)]^2$

$E[(100X)^2] = 100^2 E(X^2)$

$= 100^2 \times \frac{3}{32} \int_1^5 x^2 (6x - x^2 - 5) \cdot dx$

$= \frac{30000}{32}\left[\frac{6x^4}{4} - \frac{x^5}{5} - \frac{5x^3}{3}\right]_1^5$

$= 98000$

$var(100X) = 98000 - (300)^2 = 8000$

$E(Y) = 0.3 \times 200 = 60$

$var(Y) = 0.3 \times 200^2 - 60^2$

$= 8400$

Z = Amount of repair

$$E(Z) = E(X+Y)$$
$$= 300 + 60 = 360$$

$$var(Z) = var(X) + var(Y) = 8000 + 8400$$
$$= 16400$$

$$E(S) = E(N) \cdot E(Z)$$
$$var(S) = E(N) \cdot var(Z) + var(N) \cdot E(Z)^2$$

$$\therefore E(S) = 18000$$
$$\therefore var(S) = 50 \times 16400 + 50 \times 300^2$$
$$= 7300000$$