

PAI-SOA JOINT WEBINAR

2022 DIGITAL TRANSFORMATION & ARTIFICIAL INTELLIGENCE

13 July

SOA Antitrust Compliance Guidelines

Active participation in the Society of Actuaries is an important aspect of membership. While the positive contributions of professional societies and associations are well-recognized and encouraged, association activities are vulnerable to close antitrust scrutiny. By their very nature, associations bring together industry competitors and other market participants. The United States antitrust laws aim to protect consumers by preserving the free economy and prohibiting anti-competitive business practices; they promote competition. There are both state and federal antitrust laws, although state antitrust laws closely follow federal law. The Sherman Act, is the primary U.S. antitrust law pertaining to association activities. The Sherman Act prohibits every contract, combination or conspiracy that places an unreasonable restraint on trade. There are, however, some activities that are illegal under all circumstances, such as price fixing, market allocation and collusive bidding.

There is no safe harbor under the antitrust law for professional association activities. Therefore, association meeting participants should refrain from discussing any activity that could potentially be construed as having an anti-competitive effect. Discussions relating to product or service pricing, market allocations, membership restrictions, product standardization or other conditions on trade could arguably be perceived as a restraint on trade and may expose the SOA and its members to antitrust enforcement procedures.

While participating in all SOA in person meetings, webinars, teleconferences or side discussions, you should avoid discussing competitively sensitive information with competitors and follow these guidelines:

- **Do not** discuss prices for services or products or anything else that might affect prices
- **Do not** discuss what you or other entities plan to do in a particular geographic or product markets or with particular customers.
- **Do not** speak on behalf of the SOA or any of its committees unless specifically authorized to do so.
- **Do** leave a meeting where any anticompetitive pricing or market allocation discussion occurs.
- **Do** alert SOA staff and/or legal counsel to any concerning discussions
- **Do** consult with legal counsel before raising any matter or making a statement that may involve competitively sensitive information.

Adherence to these guidelines involves not only avoidance of antitrust violations, but avoidance of behavior which might be so construed. These guidelines only provide an overview of prohibited activities. SOA legal counsel reviews meeting agenda and materials as deemed appropriate and any discussion that departs from the formal agenda should be scrutinized carefully. Antitrust compliance is everyone's responsibility; however, please seek legal counsel if you have any questions or concerns.

Presentation Disclaimer

Presentations are intended for educational purposes only and do not replace independent professional judgment. Statements of fact and opinions expressed are those of the participants individually and, unless expressly stated to the contrary, are not the opinion or position of the Society of Actuaries, its cosponsors or its committees. The Society of Actuaries does not endorse or approve, and assumes no responsibility for, the content, accuracy or completeness of the information presented. Attendees should note that the sessions are audio-recorded and may be published in various media, including print, audio and video formats without further notice.

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Developing Actuarial Applications Using R Shiny

13th July 2022

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Debbie Ooi (Actuarial Analyst)
Nadia Suharto (Actuarial Analyst)

Why R Shiny?



R Server



User Interface (UI)



The screenshot shows the LRC Robot web application interface. The main content area displays a financial statement table with two columns for Functional Currency (THB) and Reporting Currency (USD). The table includes various financial metrics such as LRC Account, LRC excl. LC Opening Balance, Brought Forward, Adjustment, Insurance Revenue, Insurance Service Expense, Insurance Acquisition Cash Flows, Insurance Finance Income or Expense, Interest Accretion - Investment Component, Interest Accretion - Insurance Acquisition Cash Flows (Amortisation), and Change in Discount Rate - Insurance Revenue. The table is organized into two main sections: Functional Currency: THB and Reporting Currency: USD, each with its own sub-table.

Functional Currency: THB			Reporting Currency: USD		
	2020	Total		2020	Total
LRC Account			LRC Account		
LRC excl. LC Opening Balance	0.00	0.00	LRC excl. LC Opening Balance	0.00	0.00
Brought Forward	0.00	0.00	Brought Forward	0.00	0.00
Adjustment	0.00	0.00	Adjustment	0.00	0.00
Insurance Revenue	-35.52	-35.52	Insurance Revenue	-1.14	-1.14
Insurance Revenue - Adjustment	0.00	0.00	Insurance Revenue - Adjustment	0.00	0.00
Insurance Service Expense	0.00	0.00	Insurance Service Expense	0.00	0.00
Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00	Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00
Insurance Finance Income or Expense	318.15	318.15	Insurance Finance Income or Expense	10.18	10.18
Interest Accretion - Investment Component	5.76	5.76	Interest Accretion - Investment Component	0.18	0.18
Interest Accretion - Insurance Revenue	19.36	19.36	Interest Accretion - Insurance Revenue	0.62	0.62
Interest Accretion - Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00	Interest Accretion - Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00
Change in Discount Rate - Insurance Revenue	226.03	226.03	Change in Discount Rate - Insurance Revenue	7.30	7.30

Why R Shiny?

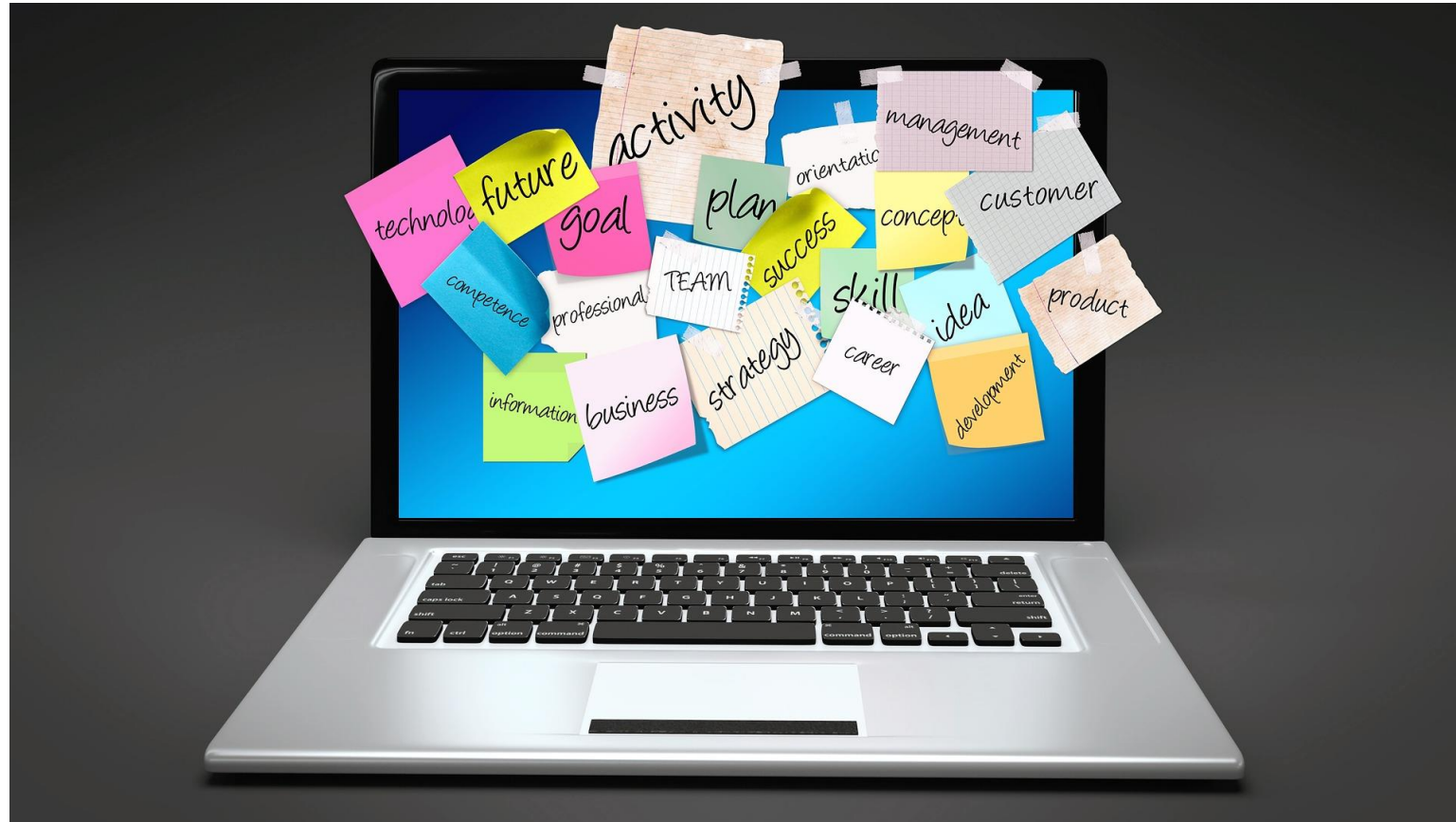
Data Size (no. of rows)	No. of CPU	Time (sec)	Memory (MB)	Relative (time)
10,000	4	10.74	2,104.0	-
	8	9.36	2,239.2	1.15x
	12	8.99	2,123.9	1.19x
50,000	4	14.11	8,205.3	-
	8	13.13	8,479.6	1.07x
	12	13.10	8,559.6	1.08x
100,000	4	21.59	16,547.5	-
	8	20.05	16,125.1	1.08x
	12	19.89	15,849.7	1.09x
300,000	4	44.86	47,662.3	-
	8	44.86	48,182.6	1.00x
	12	44.67	48,421.6	1.00x
500,000	4	77.27	57,552.0	-
	8	78.76	57,366.9	0.98x
	12	77.33	59,538.8	1.00x

Table: Sample of R Shiny App performance test using Profvis R package

How to Build R Shiny?



How to Ensure Relevance of R Shiny?



Examples of R Shiny Functions

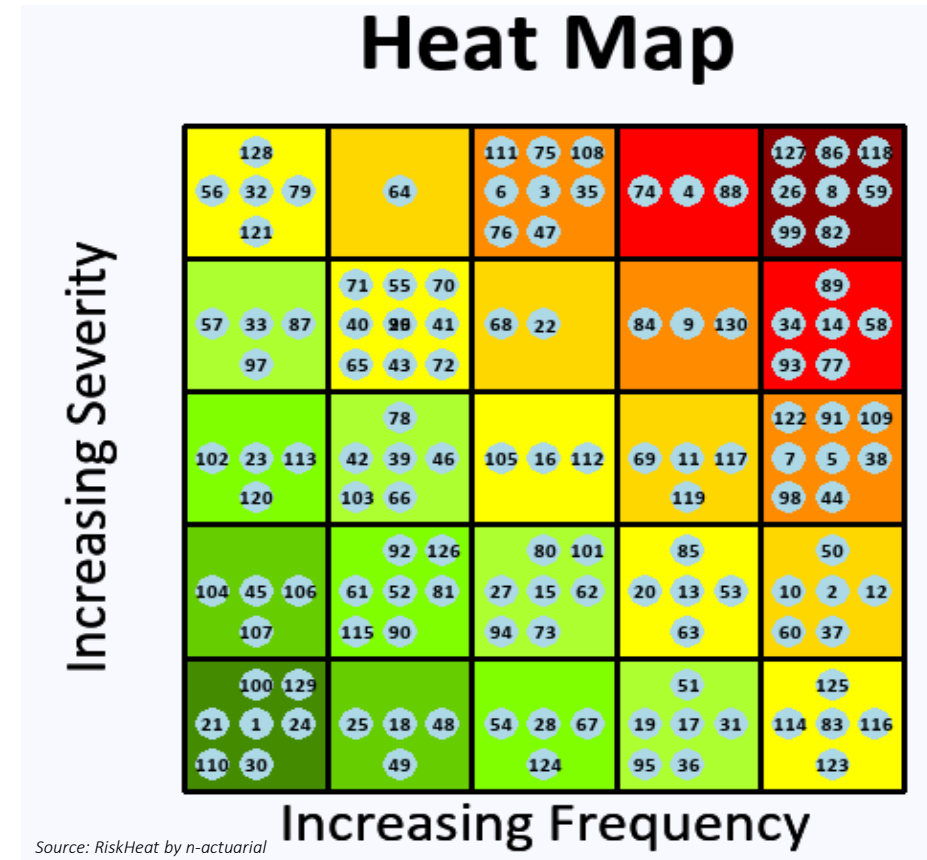
```

plotting = reactive({
  plot(c(0, 5), c(0, 5), type = "n", asp=1, main="Heat Map",
    xlim=c(0,5), ylim=c(0,5), ylab="", xlab="", axes = FALSE,
    cex.main = 3)
  mtext(text = "Increasing Severity", side = 2, line = 0, cex = 2)
  mtext(text = "Increasing Frequency", side = 1, line = 0, cex = 2)

  for ( i in 0:4 ) {
  for ( j in 0:4 ) {
    rect( 0+i, 0+j, 1+i, 1+j, border = TRUE,
      col = ifelse(i+j == 0, "chartreuse4" ,
        ifelse(i+j == 1, "chartreuse3",
          ifelse(i+j == 2, "chartreuse",
            ifelse(i+j == 3, "greenyellow" ,
              ifelse(i+j == 4, "yellow",
                ifelse(i+j == 5, "gold",
                  ifelse(i+j == 6, "darkorange",
                    ifelse(i+j == 7, "red", "darkred")))))))))))
    .
    .
    .
  }
}

output$myplot = renderPlot({
  withProgress(message = "Generating plot ...", value = 0.1,
    style = "notification", {
    plotting()
  }
}),
  bg = "ghostwhite", height = 500, width = 500)

```



Examples of R Shiny Functions

```

manual_adjustment = fread('manual adjustment.csv')

lrc_report = function(..., manual_adjustment) {
  .
  .
  manual_adj = manual_adjustment
  .
  .
  set(account_lrc, i=1L, j=j,
    value = results[DataType == ...] +
manual_adj[DataType == ...])
  .
  .
  .
}

```

Source: LRC Robot by n-actuarial
2020

LRC Account	2020	LRC Account	2020
LRC excl. LC Opening Balance	0.00	LRC excl. LC Opening Balance	58.00
Brought Forward	0.00	Brought Forward	0.00
Adjustment	0.00	Adjustment	58.00
Insurance Revenue	-35.52	Insurance Revenue	-23.52
Insurance Revenue	-35.52	Insurance Revenue	-35.52
Insurance Revenue - Adjustment	0.00	Insurance Revenue - Adjustment	12.00
Insurance Service Expense	0.00	Insurance Service Expense	0.00
Insurance Acquisition Cash Flows (Amortisation)	0.00	Insurance Acquisition Cash Flows (Amortisation)	0.00
Insurance Finance Income or Expense	318.15	Insurance Finance Income or Expense	318.15
Interest Accretion - Investment Component	5.76	Interest Accretion - Investment Component	5.76
Interest Accretion - Insurance Revenue	19.36	Interest Accretion - Insurance Revenue	19.36
Interest Accretion - Insurance Acquisition Cash Flows (Amortisation)	0.00	Interest Accretion - Insurance Acquisition Cash Flows (Amortisation)	0.00
Change in Discount Rate - Insurance Revenue	228.03	Change in Discount Rate - Insurance Revenue	228.03
Change in Discount Rate - Investment Component	64.99	Change in Discount Rate - Investment Component	64.99
Change in Discount Rate - Insurance Acquisition Cash Flows (Amortisation)	0.00	Change in Discount Rate - Insurance Acquisition Cash Flows (Amortisation)	0.00
Transfer to LIC	-0.00	Transfer to LIC	21.00
Transfer to LIC - Investment Component	-0.00	Transfer to LIC - Investment Component	21.00

Before manual adjustment

After manual adjustment

Examples of R Shiny Functions

Source: ReACC by n-actuarial

```
cession = function(input_policy,...){
  .
  .
  tbl = data.table(input_policy)
  .
  .
  tbl[, 'Aggregation' :=
    cumsum(!duplicated('PolicyNumber')),
    by = 'CustomerID']
  .
  .
}
```

Customer ID	Tranche	Policy Number	Aggregation	Entry Age	Gender	Policy Start Date
1	1	A0001	1	40	M	2011-12-12
1	1	A0001	1	40	M	2011-12-12
1	1	A0001	1	40	M	2011-12-12
1	1	A0001	1	40	M	2011-12-12
1	1	A0001	1	40	M	2011-12-12
2	1	A0002	1	30	M	2013-02-12
2	1	A0002	1	30	M	2013-02-12
2	1	A0002	1	30	M	2013-02-12
2	1	A0002	1	30	M	2013-02-12
2	1	A0002	1	30	M	2013-02-12
2	1	A0005	2	34	M	2017-02-01
2	1	A0005	2	34	M	2017-02-01
2	1	A0005	2	34	M	2017-02-01
2	1	A0005	2	34	M	2017-02-01
2	1	A0005	2	34	M	2017-02-01

Examples of R Shiny Tool

- English
- ไทย
- Setup
- Input
- Actuarial Analysis
- LRC Account
- Journal Posting
- Trial Balance
- Chart of Accounts
- Glossary
- IFRS 17 Standard

PAA
GMM

Portfolio
Class
Sub Class

Gross Motoract
Net Motoract
RI Motoract

Functional Currency: THB

LRC Account	2020	Total
LRC excl. LC Opening Balance	0.00	0.00
Brought Forward	0.00	0.00
Adjustment	0.00	0.00
Insurance Revenue	-35.52	-35.52
Insurance Revenue	-35.52	-35.52
Insurance Revenue - Adjustment	0.00	0.00
Insurance Service Expense	0.00	0.00
Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00
Insurance Finance Income or Expense	318.15	318.15
Interest Accretion - Investment Component	5.76	5.76
Interest Accretion - Insurance Revenue	19.36	19.36
Interest Accretion - Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00
Change in Discount Rate - Insurance Revenue	228.03	228.03

Reporting Currency: USD

LRC Account	2020	Total
LRC excl. LC Opening Balance	0.00	0.00
Brought Forward	0.00	0.00
Adjustment	0.00	0.00
Insurance Revenue	-1.14	-1.14
Insurance Revenue	-1.14	-1.14
Insurance Revenue - Adjustment	0.00	0.00
Insurance Service Expense	0.00	0.00
Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00
Insurance Finance Income or Expense	10.18	10.18
Interest Accretion - Investment Component	0.18	0.18
Interest Accretion - Insurance Revenue	0.62	0.62
Interest Accretion - Insurance Acquisition Cash Flows (Amortisation)	0.00	0.00
Change in Discount Rate - Insurance Revenue	7.30	7.30

- English
- ⚙️ Setup
- 📄 Input
- 📊 Actuarial Analysis
- 📁 LIC Account
- 📄 Journal Posting
- 📄 Trial Balance
- 📊 Chart of Accounts
- 📄 Underwriting Statement
- 📖 Glossary
- 📄 IFRS 17 Standard

Gross Motoract
Net Motoract
RI Motoract

ILR
PLR
IBF
PBF
ELR
EUL
IIL
IPL
IIB
IPB
Incurred Mack
Paid Mack
ALAE & ULAE
Selection
Results

Actuarial Calculations
Actuarial Projections

IFIC

Accident Year \ Development Years

	2014	2015	2016	2017	2018	2019	2020	Total
2021	191	607	10,093	12,561	11,100	44,499	161,360	240,411
2022	95	2,480	1,713	19,063	15,441	6,531	139,914	185,239
2023	48	1,240	9,330	3,236	23,434	9,085	20,534	66,907
2024		620	4,665	22,028	3,977	13,788	28,566	73,644
2025			2,333	11,014	32,494	2,340	43,352	91,533
2026				5,507	16,247	31,864	7,358	60,976
2027					8,124	15,932	110,206	134,261
2028						7,966	55,103	63,069
2029							27,551	27,551
Total	334	4,948	28,135	73,409	110,817	132,006	593,943	943,592

Showing 1 to 10 of 10 entries

IFPC

Accident Year \ Development Years

	2014	2015	2016	2017	2018	2019	2020	Total
2021	191	764	14,947	24,389	27,291	145,603	409,593	622,777

- Overview
- Results
- Accounts
- Input Data
- Checks
- Variables
- Tables
- Sessions
- How It Works
- License

Setting

Choose Tranche:

T1 T2 Total

Choose Reinsurer:

C Re B Re All

Accounts

Reinsurance accounts from 01/06/2018 to 30/06/2018

Tranche	Total	1		2	
Tranche Name	Total	T1		T2	
Reinsurer	All	C Re	All	B Re	All
Accounts Statement					
Reinsurance Premiums	1,997.14	407.97	407.97	1,589.17	1,589.17
<i>(-) Ceding Commission</i>	240.51	81.59	81.59	158.92	158.92
<i>(-) Reinsurance Claims</i>	0.00	0.00	0.00	0.00	0.00
<i>(-) Premium Tax or Levies</i>	0.00	0.00	0.00	0.00	0.00
Results before Profit Share	1,756.63	326.38	326.38	1,430.25	1,430.25
<i>(-) Profit Commission</i>	120.49	120.49	120.49	0.00	0.00
<i>(-) Profit Tax or Levies</i>	0.00	0.00	0.00	0.00	0.00
Results after Profit Share	1,636.14	205.88	205.88	1,430.25	1,430.25
Profit Commission Statement					
Results before Profit Share	1,756.63	326.38	326.38	1,430.25	1,430.25
<i>(-) Amounts Brought Forward</i>	1,787,860.28	675.64	675.64	1,787,184.64	1,787,184.64
<i>(-) Interest on Amounts Brought Forward</i>	7,346.95	2.36	2.36	7,344.59	7,344.59
<i>(-) Profit Share Expenses</i>	81.59	81.59	81.59	0.00	0.00



Heat Map

Increasing Severity



Increasing Frequency

Upload Risk Register

Browse... Risk Heat Map.csv

Upload complete

Remove Data Uploaded

Upload Report Required

Browse... Criteria.csv

Upload complete

Remove Data Uploaded

Download Reports

Risk Register

Show all rows Column visibility

Search:

ID	Risk.Type	Description	Elaboration	Frequency	Severity	Category	Direction	Velocity	Risk.Score	Risk.Owner	Mitigation	Timestamp
1	Executive Support	Executives fail to support project	The project team may lack the authority to achieve project objectives. In such cases, executive management support is fundamental to project success. When this doesn't materialize the project fails.	1	1	Strategic	Rising Steeply	Very Fast	1	D	Accept the Risk	2017-04-26
2	Executive Support	Executives become disengaged with project	Executive management disregards project communications and meetings.	5	2	Strategic	Static	Normal	10	C	Avoid the Risk	2012-10-13
3	Executive Support	Conflict between executive stakeholders disrupts project	Members of executive management are combative to the project or there is a disagreement over project issues at the executive level.	3	5	Financial	Rising	Normal	15	B	Avoid the Risk	2012-11-05

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