DecL Cheat Sheet for Compound Distributions

The DecL specification of an `Aggregate` compound distribution object has eight clauses:

`agg <NAME> <EXPOSURE> <LIMIT*> <SEVERITY> <OCC_RE*> <FREQUENCY> <AGG_RE*> <NOTE*>`

Key: `<INPUT>` denotes user input(s); clauses marked with an asterisk are optional; `lower_case` is a DecL keyword; `CLAUSE_TYPE` is a valid clause; options: `a|b|c`.

1. Name Clause

`agg NAME`

Name of the compound
Access from knowledge as `agg.NAME`.
Names must match regex
`r'[a-zA-Z][\._: a-zA-Z0-9\-]*'`.

2. Exposure Clause

`<EXP_LOSS> loss`
`<PREMIUM> premium at <LR> lr`
`<EXPOSURE> exposure at <RATE> rate`
`<CLAIMS> claims`
`dfreq <OUTCOMES> <PROBABILITIES*>`

Outcomes entered `[1 2 3 4]` or `[2:10:2]` and probabilities `[.5 .25 1/8 1/9]` or omitted for equally likely.

3. Limit Clause (optional)

`<LIMIT> xs <ATTACHMENT>`

Occurrence limits applied to ground-up severity, unlimited reinstatements, losses conditional on attaching layer by default.

4. Severity Clause

`sev <DIST_NAME> <MEAN> cv <CV>`
`sev <DIST_NAME> <SHAPE1> <SHAPE2>`
`dsev <OUTCOMES> <PROBABILITIES>`

`<SCALE> * SEV + <LOC>.`

`SEV splice [<LB> <UB>]` *conditional in layer*

`SEV !` *unconditional, when* `ATTACHMENT` *> 0*

5. Occurrence Reinsurance Clause

`occurrence ceded to LAYERS`
`occurrence net of LAYERS`
`LAYER=SHARE so LAYER xs ATTACH |`
`PARTICIPATION po LAYER xs ATTACH`
`LAYERS=LAYER1 and LAYER2 and ...`

Amount share of (`so`); participation (placed) $0 \le po \le 1$ *part of (`po`)*

`LAYERS=tower[250 500 1000]`

Specify layer breaks, expands to `250 xs 0`, `250 xs 250`, and `500 xs 500`; ground-up layer automatically added.

6. Frequency Clause

`poisson`, `bernoulli`, `fixed`, `geometric`,
`logarithmic`, `binomial XX`, `negbin var_mult`,
`pascal XX XX`, `neymana XX`
`mixed <MIXING DIST> <SHAPE1> <SHAPE2>`
`MIXING DIST=gamma|delaporte|ig|sichel|beta`
`FREQ zt`
`FREQ zm p0`

zero truncated, zero modified with $\Pr(N = 0) = p0$

7. Aggregate Reinsurance Clause

`aggregate ceded to LAYERS`
`aggregate net of LAYERS`
`aggregate (net of|ceded to) tower [<BREAKS>]`

8. Note

`note{prems op A curve, effective 1/1/2024;}`
`note{bs=100; log2=17; normalize=False}`

Add hints for updating

9. Vectorization

Exposure clause
`[1 2 3] claims`
`[100 200 300] loss`
`[100 200 300] premium at [.8 .7 .65] lr`
Layers clause
`[250 250 500] xs [0 250 500]` *zip layers*
Severity clause
`[1 3] * expon 1 wts [.6 .4]`
`[1 3] * [gamma lognorm] [4 1.25] wts [.6 .4]`
Vectors are broadcast; layers, exposure etc. are zipped.

10. Mathematical Expressions

Only division, exponentiation, and exponential allowed
`123`, `12.34e2`, `-12.4e-5`, `-12.0`, `12.4%`
`1/2`, `3**4`, `exp(2)`
Warning: *there is no unary minus, minus binds to the number:* $-4^2 = (-4)^2 = 16$.
Scale factor for lognormal μ, σ *entered as* `exp(mu)/exp(sigma**2/2)`.

Notes:

`aggregate v.0.18.0`
Confidence and precision meets
ease of use in actuarial analysis

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