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

1. Name Clause

`agg <NAME>` `agg <NAME> sev <NAME> <SEVERITY>`

Name of the compound or severity.
Names match regex
`r'[a-zA-Z][\._: a-zA-Z0-9\-]*'`.
Created objects can be referenced
`agg.<NAME>` `agg <NEW_NAME> agg.<OLD_NAME>`

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>`
`sev sev.<NAME>`
`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>`
`LAYERS=LAYER1 and LAYER2 and ...`

$0 \le$ SHARE ≤ 1 *share of (so)*

`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 <P>`, `negbin <VAR_MULT>`, `neymana <CLAIMS-PER-OCC>`, `pascal <CV> <CLAIMS-PER-OCC>`
`mixed <MIXING DIST> <SHAPE1> <SHAPE2>`
`MIXING DIST=gamma|delaporte|ig|sig|sichel|beta <CV> <VARIES>`
`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; split on semicolon then split on equals.

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]`
`100 * lognorm [.75 1.5] wts [.6 .4] slice [0 200 inf] 100 * lognorm [.5 .75 1.5] wts [.4 .4 .2] slice [0 0 200] [200 200 inf]`
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)`
Scale factor for lognormal μ, σ entered as `exp(mu)/exp(sigma**2/2)`.
Warning: *minus binds to the number:*
$-4^2 = (-4)^2 = 16$*; there is no unary minus.*

`aggregate v.0.20.0`
Confidence and precision meets ease of use in actuarial analysis