Atlas Math

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Table 1: Symbols

Symbol	Spec
a	Leverage Adjusted Drift To Risk Ratio
a	Lower Bound
a	Low risk parameter
AF	Audit Factor
AGEeff	Effective Age
ARR	Administrative Risk Rating
auditAge	Audit Age
b	Upper Bound
b	Constant factor
b	Medium risk parameter
c	High risk parameter
C_{tot}	Total Collateral
CA	Contract Age
CAP	Administrative Risk Rating Cap
CAP	Smart Contract Risk Rating Cap
CCR	Code Complexity Rate
CCRMax	Code Complexity Rating Maximum
CCRUpperBound	Code Complexity Rating Upper Bound
CCweight	Cyclomatic Complexity Weight
coverage	Coverage
CR	Capital Ratio without additional buffers
CS	Code Size
CSfactor	Code Size Factor
CSweight	Code Size Weight
d	Extreme risk parameter
D_0^i	Debt
d_1	Distance To Default
d_2	Downward Adjusted Distance To Default
decayFactor	Decay Factor
DF	Delay Adjustment Factor
DPweight	Decision Points Weight
E_{beyond}	Exposure Beyond Surplus
e	Base of the natural logarithm
e_{int}	Internal Exposure
e_{tot}	Total Exposure
EAD	Exposure At Default
ECR	Effective Capital Ratio
ECweight	External Calls Weight
effAuditValue	Effective Audit Value
effectivenessCoefficient	Effectiveness Coefficient
f_1	F1 Required Capital Percentage
f_2	F2 Required Capital Percentage
gmTVL	Geometric Mean Total Value Locked
i	Rating Point Scaling Coefficient
i_{kink}	Kink Location Fraction
i_{max}	Maximum Interval Width

Table 2: More Symbols

Symbol	Spec
ID	Inheritance Depth
IDweight	Inheritance Depth Weight
K	Sensitivity Factor
K	Capital Requirement Without Buffers
LAF	Lindy Adjustment Factor
LGD	Loss Given Default
LinesOfCodeCovered	Lines Of Code Covered
ln	The natural logarithm
LP	Liquidation Penalty
LT	Liquidation Threshold
max	Maximum Age
max	Math max function that returns the greater of two parameters
min	Math min function that returns the lower of two parameters
N	Cumulative probability distribution function for the normal distribution
PD	Probability Of Default
R	Asset Correlation Coefficient
r	Risk Rating of the protocol
r_c^i	Return On Asset
r_d^j	Cost Of Debt
r_i	Reference Inflection Risk Rating
r_s^i	Asset Yield
r_s^j	Debt Yield
RawCCR	Raw Code Complexity Rating
RCC	Piecewise Function
RRC	Required Risk Capital
S	Estimated slippage for liquidating the entire position in one block
s_{liq}	Internal Liquid Surplus
SCRR	Smart Contract Risk Rating
slippageBTC	Slippage for a Native Bitcoin (BTC) exposure
slippageETH	Slippage for a Native Ether (ETH) exposure
slippageSOL	Slippage for a Native Solana (SOL) exposure
SR	Starting Rate
TCC	Total Cyclomatic Complexity
TDP	Total Decision Points
TEC	Total External Calls
TotalLinesOfCode	Total Lines Of Code
TVLthreshold	Total Value Locked Threshold
V_0^i	Collateral value
w_D^j	Weight Of Debt Instrument In Debt Portfolio
w_U^i	Weight Of Asset In Underlying Asset Portfolio
x	Final Required Capital Percentage
x_{kink}	Kink Threshold
$x_{\max}$	Maximum Threshold
x_{start}	Starting Threshold

Table 3: Greek Letter Symbols

Symbol	Spec
α	Weighting factor
λ	Decay Factor
ρ	Correlation coefficient between two instruments
$\rho_{VD,ij}$	Correlation coefficient between the asset i and the debt instrument j
ρ_{UD}	Correlation Between Asset Portfolio And Debt Portfolio
σ_D^2	Total Variance Of Debt Portfolio
σ_U^2	Total Variance Of Underlying Asset Portfolio

The following formulas and explanations are taken from the Atlas as of the date 5-Nov-2025.

- A.3.2.3.1.1.1.1.1.1 - Calculate Probability Of Default

The first step is calculating the Probability Of Default PD.

$$\mathrm{PD} = N(-d_1) + N(-d_2)\left(\frac{\sum_{i=1}^{n} \mathrm{LT}_i V_0^i}{\sum_{j=1}^{m} D_0^j}\right)^{-2a}$$

Here N is the normal cumulative probability distribution function, and a is Leverage Adjusted Drift To Risk Ratio.

- A.3.2.3.1.1.1.1.1.1.1 - Leverage Adjusted Drift To Risk Ratio

$$a = \frac{\sum_{i=1}^{n} w_U^i (r_c^i + r_s^i) - \sum_{j=1}^{m} w_D^j (r_d^j + r_s^j) + \rho_{UD}\sigma_U\sigma_D - \sigma_U^2}{\sigma_U^2 + \sigma_D^2 - 2\rho_{UD}\sigma_U\sigma_D}$$

- A.3.2.3.1.1.1.1.1.1.2 - Distance To Default

$$d_1 = \frac{\ln\left(\frac{\sum_{i=1}^{n} \mathrm{LT}_i V_0^i}{\sum_{j=1}^{m} D_0^j}\right) + \left(\sum_{i=1}^{n} w_U^i (r_c^i + r_s^i) - \sum_{j=1}^{m} w_D^j (r_d^j + r_s^j) + \rho_{UD}\sigma_U\sigma_D - \sigma_U^2\right) T}{\sqrt{\sigma_U^2 + \sigma_D^2 - 2\rho_{UD}\sigma_U\sigma_D}\sqrt{T}}$$

- A.3.2.3.1.1.1.1.1.1.3 - Downward Adjusted Distance To Default

$$d_2 = \frac{\ln\left(\frac{\sum_{i=1}^{n} \mathrm{LT}_i V_0^i}{\sum_{j=1}^{m} D_0^j}\right) - \left(\sum_{i=1}^{n} w_U^i (r_c^i + r_s^i) - \sum_{j=1}^{m} w_D^j (r_d^j + r_s^j) + \rho_{UD}\sigma_U\sigma_D - \sigma_U^2\right) T}{\sqrt{\sigma_U^2 + \sigma_D^2 - 2\rho_{UD}\sigma_U\sigma_D}\sqrt{T}}$$

- A.3.2.3.1.1.1.1.1.1.4 - Total Variance Of Underlying Asset Portfolio

$$\sigma_U^2 = \sum_{i,k=1}^{n} w_U^i w_U^k \sigma_V^i \sigma_V^k \rho_{V,ik}$$

- A.3.2.3.1.1.1.1.1.1.5 - Total Variance Of Debt Portfolio

$$\sigma_D^2 = \sum_{j,l=1}^{m} w_D^j w_D^l \sigma_D^j \sigma_D^l \rho_{D,jl}$$

- A.3.2.3.1.1.1.1.1.1.6 - Correlation Between Asset Portfolio And Debt Portfolio

$$\rho_{UD} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} w_U^i w_D^j \sigma_V^i \sigma_D^j \rho_{VD,ij}}{\sqrt{\sigma_U^2 \sigma_D^2}}$$

- A.3.2.3.1.1.1.1.1.1.7 - Weight Of Asset In Underlying Asset Portfolio

$$w_U^i = \frac{\mathrm{LT}_i V_0^i}{\sum_{k=1}^{n} \mathrm{LT}_k V_0^k}$$

- A.3.2.3.1.1.1.1.1.1.8 - Weight Of Debt Instrument In Debt Portfolio

$$w_D^j = \frac{D_0^j}{\sum_{l=1}^m D_0^l}$$

- A.3.2.3.1.1.1.1.1.1.9 - Return On Asset

The Return On Asset r_c^i of an asset i is the yield earned for supplying the asset in the lending market.

- A.3.2.3.1.1.1.1.1.1.10 - Asset Yield

The Asset Yield r_s^i of an asset i is the income yield of the asset and would include any dividends or interest paid by the asset and/or asset issuer, including staking rewards for yield-bearing assets.

- A.3.2.3.1.1.1.1.1.1.11 - Cost Of Debt

The Cost Of Debt r_d^j of a debt instrument j is the interest rate on the debt.

- A.3.2.3.1.1.1.1.1.1.12 - Debt Yield

The Debt Yield r_s^j of a debt instrument j is the income yield on the debt asset. It includes any dividends or interest paid by the debt asset and/or debt asset issuer, including staking rewards for yield-bearing debt assets.

- A.3.2.3.1.1.1.1.1.1.13 - Correlation Coefficient

The correlation coefficient ρ between two instruments is the correlation of block-weighted log returns of those assets over the last 365 days. In the documents herein, the correlation coefficient is followed by subscripts indicating the relevant instruments. For example, ρ_{UD} is the correlation between the underlying asset portfolio U and the debt portfolio D. The subscript may begin with V or D to indicate whether the relevant instruments are part of the asset portfolio or debt portfolio. For example, $\rho_{VD,ij}$ is the correlation coefficient between the asset i and the debt instrument j.

- A.3.2.3.1.1.1.1.1.1.14 - Liquidation Threshold

The Liquidation Threshold

$$\mathrm{LT}_i$$

is the value of the debt as a percentage of the collateral value at which the lender may liquidate the collateral to satisfy the debt.

- A.3.2.3.1.1.1.1.1.1.15 - Asset Value

The Asset Value V_0^i of an asset i is the market value of that asset.

- A.3.2.3.1.1.1.1.1.1.16 - Debt Value

The Debt Value D_0^i of a debt instrument is the notional value of the debt.

- A.3.2.3.1.1.1.1.1.1.17 - Time Horizon

The Time Horizon T is the time horizon in years over which the Probability Of Default is being estimated. The value of the T parameter is 1.

- A.3.2.3.1.1.1.1.1.2 - Calculate Loss Given Default

The second step is calculating the Loss Given Default LGD.

$$\mathrm{LGD} = \min\left(1 - \frac{(1-\mathrm{LP})\cdot(1-S)}{\mathrm{LT}_i},\ 0\right)$$

Here min is the mathematical minimum function that returns the lower of the two specified parameters.

The parameters of this formula are specified in the subdocuments herein. All of these parameters should be specified as decimal numbers. For example, 3% should be specified as 0.03.

- A.3.2.3.1.1.1.1.1.2.1 - Liquidation Penalty

The Liquidation Penalty LP is the contractually agreed upon liquidation penalty if the asset is liquidated to satisfy the debt.

- A.3.2.3.1.1.1.1.1.2.2 - Slippage

The Slippage S is the estimated slippage for liquidating the entire position in one block. The estimated slippage should not exceed 25%.

- A.3.2.3.1.1.1.1.1.2.3 - Liquidation Threshold

The Liquidation Threshold LT_i is the value of the debt as a percentage of the collateral value at which the lender may liquidate the collateral to satisfy the debt.

- A.3.2.3.1.1.1.1.1.3 - Calculate Asset Correlation Coefficient

The third step is to calculate the Asset Correlation Coefficient R.

$$R = a \times \left(1 - e^{-K\times\mathrm{PD}}\right) + b \times \left(1 - \left(1 - e^{-K\times\mathrm{PD}}\right)\right)$$

Here e is the base of the natural logarithm, and
a is Lower Bound, b is Upper Bound, and K is Sensitivity Factor.

- A.3.2.3.1.1.1.1.1.3.1 - Lower Bound

The Lower Bound a is an estimate of the correlation between assets during "calm" periods. It is set of 0.13.

- A.3.2.3.1.1.1.1.1.3.2 - Upper Bound

The Upper Bound b is an estimate of the correlation between assets during "stressful" market environments. It is set to 0.33.

- A.3.2.3.1.1.1.1.3.3 - Sensitivity Coefficient

The Sensitivity Factor K is a tuning parameter indicating how quickly the correlations transition between a and b. It is set to 10.

- A.3.2.3.1.1.1.1.4 - Calculate Capital Requirement Without Buffers

The fourth step is to calculate the Capital Requirement Without Buffers K.

$$K = \left[\mathrm{LGD} \times N \left(\frac{N^{-1}(\mathrm{PD}) + \sqrt{R} \cdot N^{-1}(0.999)}{\sqrt{1-R}} \right) - \mathrm{PD} \times \mathrm{LGD} \right]$$

Here N is the cumulative probability distribution function for the normal distribution and N^{-1} is the inverse cumulative probability distribution function for the normal distribution.

- A.3.2.3.1.1.1.1.5 - Calculate Required Risk Capital

The final step is to calculate the Instance Financial Required Risk Capital RRC.

$$\mathrm{RRC} = K \times \frac{1}{\mathrm{CR}} \times \mathrm{EAD} \times \mathrm{ECR}$$

Here K is Capital Requirement Without Buffers.

- A.3.2.3.1.1.1.1.5.1 - Capital Ratio

The Capital Ratio CR is the capital ratio without additional buffers. It is set to 8.75%.

- A.3.2.3.1.1.1.1.5.2 - Exposure At Default

The Exposure At Default EAD is the total amount of funds from the Allocation System that have been deployed into the decentralized lending protocol.

- A.3.2.3.1.1.1.1.5.3 - Effective Capital Ratio

The Effective Capital Ratio ECR is the capital ratio included additional capital buffers established by Sky Governance as part of the Risk Framework. There are currently no additional capital buffers so the ECR is equal to the CR, which is 8.75%.

- A.3.2.3.1.1.1.1.3.1.1 - Native BTC Slippage Parameters

The Slippage for a Native BTC exposure is calculated as half the Slippage for an ETH exposure of the same USD amount:

$$\mathrm{slippageBTC} = \frac{\mathrm{slippageETH}}{2}$$

For example, if the Slippage for a $40M ETH exposure is 2% then the Slippage for a $40M Native BTC exposure would be 1%.

- A.3.2.3.1.1.1.1.3.1.2 - Native SOL Slippage Parameters

The Slippage for a Native SOL exposure is calculated as double the Slippage for an ETH exposure of the same USD amount:

$$\text{slippageSOL} = 2 \times \text{slippageETH}$$

For example, if the Slippage for a \$40M ETH exposure is 2% then the Slippage for a \$40M Native SOL exposure would be 4%.

- A.3.2.3.1.2.2 - Smart Contract Risk Rating Calculation

The second step in calculating the Instance Smart Contract RRC with respect to an Allocation System opportunity is to calculate the Smart Contract Risk Rating SCRR for the covered smart contracts.

$$\text{SCRR} = \min\left[\text{CAP},\ (\text{SR} + \text{CCR}) \times \text{LAF} \times \text{AF}\right]$$

Here min is the mathematical minimum function that returns the lesser of the specified parameters, and
CAP is Smart Contract Risk Rating Cap.

- A.3.2.3.1.2.2.1 - Smart Contract Risk Rating Cap

The Smart Contract Risk Rating Cap CAP is a temporary cap on the Smart Contract Risk Rating. The value of the CAP is 30.

- A.3.2.3.1.2.2.2 - Starting Rate

The Starting Rate SR is an arbitrary starting risk rating for protocols. The value of the SR is 25.

- A.3.2.3.1.2.2.3 - Code Complexity Rating

The Code Complexity Rate CCR is a measure of the complexity of the code of the smart contracts used by the protocol.

$$\text{CCR} = \text{CCRMax} \times \min\left(1,\ \frac{\text{RawCCR} + 1}{\text{CCRUpperBound} + 1}\right)$$

Here the min function is the mathematical minimum function that returns the lesser of the specified parameters.

- A.3.2.3.1.2.2.3.1 - Code Complexity Rating Maximum

The Code Complexity Rating Maximum CCRMax is the maximum Code Complexity Rating for a protocol. The CCRMax is set to 75.

- A.3.2.3.1.2.2.3.2 - Code Complexity Rating Upper Bound

The Code Complexity Rating Upper Bound CCRUpperBound is an arbitrary factor to normalize the Raw Code Complexity Rating. The CCRUpperBound is set to $8,500$.

- A.3.2.3.1.2.2.3.3 - Raw Code Complexity Rating

The Raw Code Complexity Rating RawCCR is an unnormalized measure of the complexity of the code of the smart contracts that implement the protocol.

$$\begin{aligned}\text{RawCCR} = (\text{TCC} \times \text{CCweight}) + (\text{TDP} \times \text{DPweight}) + (\text{TEC} \times \text{ECweight})\\ +(\text{ID} \times \text{IDweight}) + \left(\frac{\text{CS}}{\text{CSfactor}} \times \text{CSweight}\right)\end{aligned}$$

- A.3.2.3.1.2.2.3.3.1 - Total Cyclomatic Complexity

Cyclomatic complexity measures the number of independent execution paths through a unit of code. The total cyclomatic complexity score is the sum of the cyclomatic complexity of each of the covered smart contracts.

- A.3.2.3.1.2.2.3.3.2 - Cyclomatic Complexity Weight

The Cyclomatic Complexity Weight CCweight is a weighting factor indicating the relative importance of the Total Cyclomatic Complexity versus other factors. It is set to 1.

- A.3.2.3.1.2.2.3.3.3 - Total Decision Points

Decision points measure the number of branching points where conditional logic is applied. The Total Decision Points are the total number of Decision Points in all functions in the covered smart contracts.

- A.3.2.3.1.2.2.3.3.4 - Decision Points Weight

The Decision Points Weight DPweight is a weighting factor indicating the relative importance of the Total Decision Points versus other factors. It is set to 0.5.

- A.3.2.3.1.2.2.3.3.5 - Total External Calls

Total External Calls is the count of all external calls (e.g. `call`, `delegatecall`) made in the covered smart contracts.

- A.3.2.3.1.2.2.3.3.6 - External Calls Weight

The External Calls Weight ECweight is a weighting factor indicating the relative importance of the Total External Calls versus other factors. It is set to 1.5.

- A.3.2.3.1.2.2.3.3.7 - Inheritance Depth

Inheritance Depth is the maximum number of inheritance levels in any contract in the covered contracts.

- A.3.2.3.1.2.2.3.3.8 - Inheritance Depth Weight

The Inheritance Depth Weight IDweight is a weighting factor indicating the relative importance of the Inheritance Depth versus other factors. It is set to 5.

- A.3.2.3.1.2.2.3.3.9 - Code Size

Code Size is the total number of lines of code in the covered contracts, excluding tests and documentation.

- A.3.2.3.1.2.2.3.3.10 - Code Size Factor

The Code Size Factory is an arbitrary factor to normalize the Code Size relative to other parameters. It is set to $1,000$.

- A.3.2.3.1.2.2.3.3.11 - Code Size Weight

The Code Size Weight CSweight is a weighting factor indicating the relative importance of the Code Size versus other factors. It is set to 1.

- A.3.2.3.1.2.2.4 - Lindy Adjustment Factor

The Lindy Adjustment Factor LAF is a measure of the "Lindiness" of the smart contracts and is based on the idea that vulnerable smart contracts with large TVL for a significant period of time would have already been hacked. Therefore, protocols with a greater time integrated TVL are safer, all other things equal, than protocols with a lower time integrated TVL.

$$\mathrm{LAF} = \max\left(0,\ 1 - \frac{\ln(1 + \lambda \times \mathrm{AGEeff})}{\ln(1 + \lambda \times \max)}\right)$$

Here max is the mathematical maximum function that returns the greater of the specified parameters and ln is the natural logarithm.

- A.3.2.3.1.2.2.4.1 - Decay Factor

The Decay Factor λ is a tuning parameter that represents an estimate of how quickly the risk of a set of smart contracts decreases as its effective age increases. The value of λ is set to 0.1.

- A.3.2.3.1.2.2.4.2 - Maximum Age

The Maximum Age max is the effective age, in months, at which the risk of a set of smart contracts has decayed to zero. The value of max is set to 60.

- A.3.2.3.1.2.2.4.3 - Effective Age

The Effective Age AGEeff is the age of the contracts adjusted for the TVL of the contracts.

$$\mathrm{AGEeff} = \mathrm{CA} \times \ln\left(1 + \frac{\mathrm{gmTVL}}{\mathrm{TVLthreshold}}\right)$$

Here ln is the natural logarithm.

- A.3.2.3.1.2.2.4.3.1 - Contract Age

The contract age CA is the average age, in months, of each of the relevant contracts. The age of each relevant contract should be measured based on the time elapsed between the date the contract was deployed and the date of calculation.

- A.3.2.3.1.2.2.4.3.2 - Geometric Mean Total Value Locked

The Geometric Mean Total Value Locked gmTVL is the geometric mean of the daily TVL over the contract age.

- A.3.2.3.1.2.2.4.3.3 - Total Value Locked Threshold

The Total Value Locked Threshold TVLthreshold is a factor used to normalize the Geometric mean Total Value Locked. The TVLthreshold is set to $100,000,000$.

- A.3.2.3.1.2.2.5 - Audit Factor

The Audit Factor AF is a measure of the extent to which the Base Risk is reduced by audits.

$$\mathrm{AF} = \Pi[1 - \mathrm{effAuditValue} \times \mathrm{decayFactor}]$$

The audit from each audit firm with the highest product of Effective Audit Value and Delay factor should be included in this calculation.

- A.3.2.3.1.2.2.5.1 - Effective Audit Value

The Effective Audit Value effAuditValue measures the effectiveness of a single audit in reducing the risk of a set of smart contracts and is a function of the percent of the code covered by the audit and the reputation of the audit firm.

$$\mathrm{effAuditValue} = \mathrm{effectivenessCoefficient} \times \mathrm{coverage}$$

- A.3.2.3.1.2.2.5.1.1 - Coverage

The Coverage coverage is a measure of the percent of a set of smart contracts that were covered in the scope of an audit.

$$\mathrm{coverage} = \frac{\mathrm{LinesOfCodeCovered}}{\mathrm{TotalLinesOfCode}}$$

- A.3.2.3.1.2.2.5.1.1.1 - Lines Of Code Covered

The Lines Of Code Covered LinesOfCodeCovered is the number of lines of code of the relevant contracts that were within the scope of the audit, excluding documentation and tests.

- A.3.2.3.1.2.2.5.1.1.2 - Total Lines Of Code

The Total Lines Of Code TotalLinesOfCode is the total number of lines of code of the relevant contracts, excluding documentation and tests.

- A.3.2.3.1.2.2.5.1.2 - Effectiveness Coefficient

The Effectiveness Coefficient effectivenessCoefficient is a measure of the effectiveness of the particular audit firm and is estimated based on the tier of the audit firm.

- A.3.2.3.1.2.2.5.1.2.1 - Audit Firm Tiers

Audit firms are divided into two tiers: top-tier and mid-tier.

- A.3.2.3.1.2.2.5.1.2.1.1 - Top-Tier Effectiveness Coefficient

The Effectiveness Coefficient of a top-tier audit firm is set to 0.8.

- A.3.2.3.1.2.2.5.1.2.1.2 - Mid-Tier Effectiveness Coefficient

The Effectiveness Coefficient of a mid-tier audit firm is set to 0.5.

- A.3.2.3.1.2.2.5.2 - Decay Factor

The Decay Factor decayFactor is a parameter indicating how rapidly the effectiveness of audits in reducing risk decreases over time.

$$\text{decayFactor} = \begin{cases} 1 & \text{if auditAge} \leq 2 \\ \frac{10-\text{auditAge}}{8} & \text{if } 2 < \text{auditAge} < 10 \\ 0 & \text{if auditAge} \geq 10 \end{cases}$$

- A.3.2.3.1.2.2.5.2.1 - Audit Age

The Audit Age auditAge is the age, in years, of the audit. The age of the audit should be measured based on the time elapsed between the date the audit report was issued and the date of calculation.

- A.3.2.3.1.2.3.1.2.5 - Calculate Blended Average Required Capital Percentage

The final Required Capital Percentage x should be calculated as a weighted average of the F1 Required Capital Percentage and the F2 Required Capital Percentage as follows:

$$x = b \times \alpha \times f_2 + (1 - \alpha) \times f_1$$

Here b is a constant factor.
A.3.2.3.1.2.3.1.2.5.1 - Constant Factor
The constant factor b is set to 0.15.

- A.3.2.3.1.2.3.1.2.5.2 - Alpha

Alpha α is a weighting factor indicating how close the Risk Rating is to the threshold for a High Risk Protocol versus the threshold for a Low Risk Protocol.

$$\alpha = \frac{r - 25}{50 - 25}$$

Here r is the Risk Rating of the protocol.

- A.3.2.3.1.2.3.3.1 - Piecewise Function

The Piecewise Function CRR(x) calculates a percentage risk capital requirement based on an input x.

$$\text{RCC}(x) = \begin{cases} a & \text{if } x \leq x_{\text{start}} \\ b \times \frac{x - x_{\text{start}}}{x_{\text{kink}} - x_{\text{start}}} & \text{if } x_{\text{start}} < x \leq x_{\text{kink}} \\ b + c\frac{x - x_{\text{kink}}}{x_{\text{max}} - x_{\text{kink}}} & \text{if } x_{\text{kink}} < x < x_{\text{max}} \\ d & \text{if } x \geq x_{\text{max}} \end{cases}$$

Here a is low risk parameter and b is medium risk parameter.

- A.3.2.3.1.2.3.3.1.1 - Low Risk Parameter

The low risk parameter a is the output of the piecewise function when the input is at or below the starting threshold. The a parameter is set to 0.

- A.3.2.3.1.2.3.3.1.2 - Medium Risk Parameter

The medium risk parameter b is the output of the piecewise function when the input is equal to the kink threshold. The b parameter is set to 0.25.

- A.3.2.3.1.2.3.3.1.3 - High Risk Parameter

The high risk parameter c is the incremental value above the b parameter that the piecewise function will output when the input is equal to the maximum threshold. The c parameter is set to 0.75.

- A.3.2.3.1.2.3.3.1.4 - Extreme Risk Parameter

The extreme risk parameter d is the output of the piecewise function when the input is equal to or greater than the maximum threshold. The d parameter is set to 1.

- A.3.2.3.1.2.3.3.1.5.1 - Starting Threshold

$$x_{\text{start}}(r) = i \times (r_i - r)$$

Here r is the Risk Rating.

- A.3.2.3.1.2.3.3.1.5.2 - Maximum Threshold

$$x_{\max}(r) = x_{\text{start}}(r) + i_{\max}$$

Here r is the Risk Rating.

- A.3.2.3.1.2.3.3.1.5.3 - Kink Threshold

$$x_{\text{kink}}(r) = x_{\text{start}}(r) + i_{\text{kink}} \times [x_{\max}(r) - x_{\text{start}}(r)]$$

Here r is the Risk Rating.

- A.3.2.3.1.2.3.3.1.5.4 - Threshold Parameters

The documents herein define inputs that are used to calculate the Starting Threshold, Maximum Threshold, and Kink Threshold. These parameters differ depending on whether the piecewise function is invoked with F1 threshold parameters or F2 threshold parameters.

- A.3.2.3.1.2.3.3.1.5.4.1 - F1 Threshold Parameters

$$\begin{aligned} i &\equiv 0.01 \\ r_i &\equiv 50 \\ i_{\max} &\equiv 0.50 \\ i_{\text{kink}} &\equiv 0.75 \end{aligned}$$

- A.3.2.3.1.2.3.3.1.5.4.2 - F2 Threshold Parameters

$$
\begin{aligned}
i &\equiv 0.02 \\
r_i &\equiv 75 \\
i_{\text{max}} &\equiv 0.50 \\
i_{\text{kink}} &\equiv 0.75
\end{aligned}
$$

- A.3.2.3.1.2.3.3.2.1.1 - Internal Exposure

The Internal Exposure e_{int} is the Agent's allocation to the protocol.

- A.3.2.3.1.2.3.3.2.1.2 - Total Exposure

The Total Exposure e_{tot} is the Sky Ecosystem's aggregate allocation to the protocol.

- A.3.2.3.1.2.3.3.2.1.3 - Internal Liquid Surplus

The Internal Liquid Surplus s_{liq} is equal to the Total Risk Capital of the Agent.

- A.3.2.3.1.2.3.3.2.1.4 - Exposure Beyond Surplus

The Exposure Beyond Surplus E_{beyond} is the difference between the Sky Ecosystem's aggregate allocation to the protocol and aggregate internal liquid surplus of all Agents.

- A.3.2.3.1.2.3.3.2.1.5 - Total Collateral

The Total Collateral C_{tot} is the total USDS and Dai debt in the system.

- A.3.2.3.1.2.3.3.2.2 - F1 Function

The F1 parameter f_1 is calculated as follows:

$$f_1 = \frac{E_{\text{beyond}}}{C_{\text{tot}}}$$

- A.3.2.3.1.2.3.3.2.3 - F2 Function

The F2 parameter f_2 is calculated as follows:

$$f_2 = \frac{e_{\text{int}} + \alpha\,(e_{\text{tot}} - e_{\text{int}})}{s_{\text{liq}}}$$

Here α is equal to 0.1.

- A.3.2.3.1.3.1 - Administrative Risk Rating Calculation

The first step in calculating the Instance Administrative RRC with respect to an Allocation System opportunity is to calculate the Administrative Risk Rating ARR for the protocol being invested in.

$$\text{ARR} = \min[\text{CAP},\ \text{SR} \times \text{DF} \times \text{LAF}]$$

Here min is the mathematical minimum function that returns the lesser of the specified parameters, and
CAP is Administrative Risk Rating Cap.

- A.3.2.3.1.3.1.1 - Administrative Risk Rating Cap

The Administrative Risk Rating Cap CAP is a temporary cap on the Administrative Risk Rating. The value of the CAP is 30.

- A.3.2.3.1.3.1.2 - Starting Rating

The Starting Rate SR is an initial risk rating for Administrative Risk before taking into account the Delay Factor and Lindy Adjustment Factor. It is a function of the type of backdoor access that exists to the protocol, as specified in the documents herein.

- A.3.2.3.1.3.1.2.1 - No Backdoor

A protocol with no backdoor access allows no privileged access to the relevant smart contracts by a whitelisted set of users. The Starting Rate for a protocol with no backdoor access is 0.

- A.3.2.3.1.3.1.2.2 - Limited Backdoor

A protocol with limited backdoor access allows a set of privileged users to materially modify the terms of the smart contracts (e.g. freezing the transfer of funds) but does not allow root backdoor access. The Starting Rate for a protocol with limited backdoor access is 50.

- A.3.2.3.1.3.1.2.3 - Root Backdoor

A protocol with root backdoor access allows a set of privileged users to make arbitrary changes to the terms of the smart contracts, including transferring user funds. The Starting Rate for a protocol with root backdoor access is 100.

- A.3.2.3.1.3.1.3 - Delay Factor

The Delay Adjustment Factor DF is a factor indicating the extent to which the risk associated with backdoor access is mitigated by a security delay between the time that a change using backdoor access is approved and the time that such a change becomes effective. This delay gives users time to raise issues or withdraw funds in the event of malicious or undesirable use of backdoor access.

The Delay Factor is 1 if there is no security delay and 0 if the security delay is 48 hours or greater. For security delays between 0 hours and 48 hours, the Delay Factor is linearly reduced for each hour of security delay. So a security delay of 24 hours would result in a Delay Factor of 0.5.