Methodology

Start: Run SCR Model Script

Step 1: Load & Prepare Data
Use Pandas to load Excels:
- MI Pack (BS, PL)
- Mulsanne Manual Assumptions (e.g., risk factors, payment patterns)

Step 2: Calculate Individual Risk Module SCRs
Call separate functions for each risk category

Market Risk Module
Calculate Interest Rate SCR
Calculate Spread, Equity, Currency, & Concentration SCR

Counterparty Risk Module
Calculate Type 1 (Reinsurance) SCR
Calculate Type 2 (Intermediaries) SCR

Non-Life Underwriting Risk Module
Calculate Premium & Reserve Risk SCR
Calculate Catastrophe Risk SCR

Step 3: Calculate BSCR by aggregating the risk module outputs
Combine module outputs using the Solvency II correlation matrix

Step 4: Calculate Operational Risk SCR
(Input required from BSCR)

Step 5: Calculate Final SCR
BSCR + OpRisk SCR + Capital Add-ons

End: Output SCR Report
- Total SCR (£)
- Breakdown by risk module
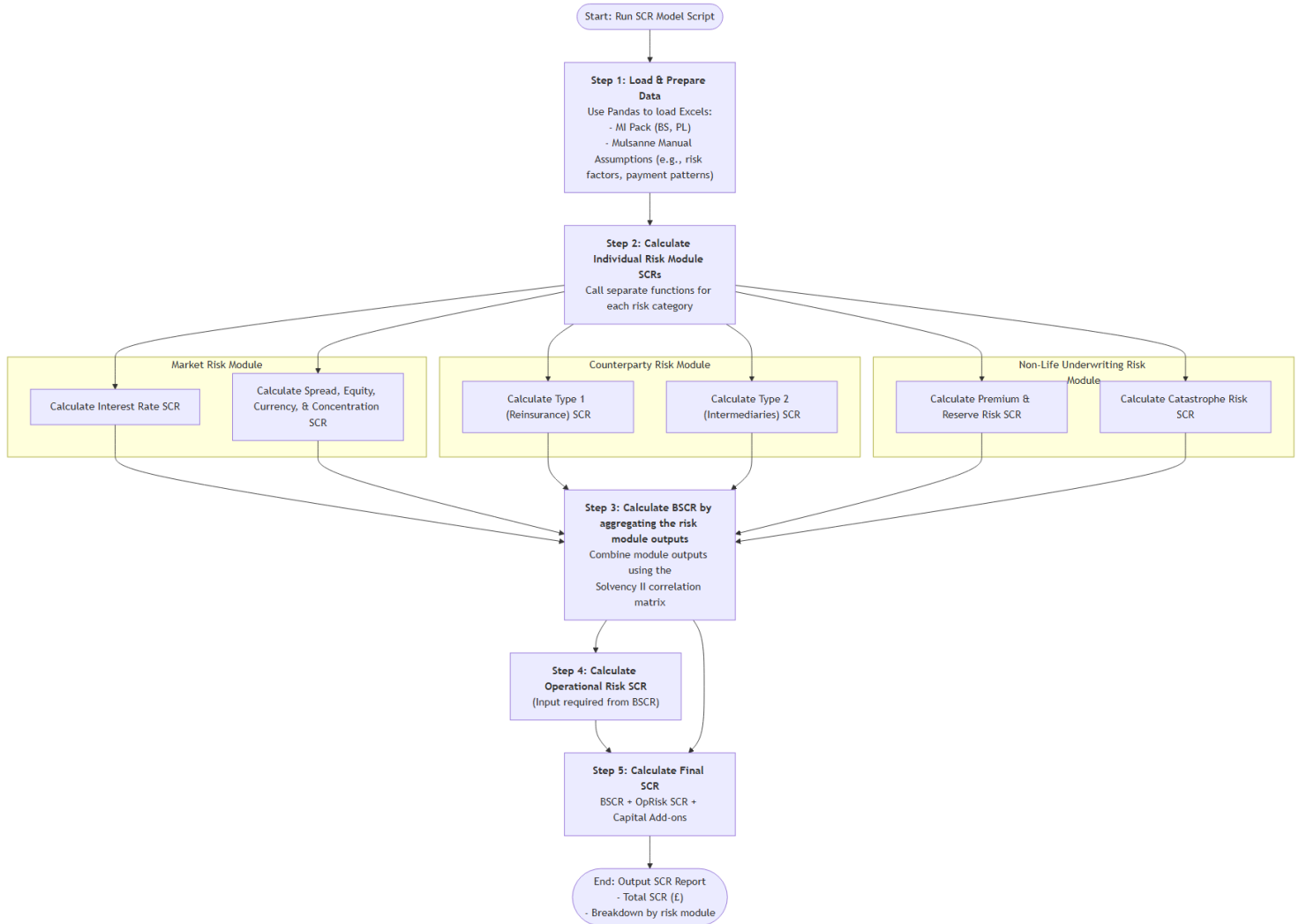
1. Data Inputs from MI Pack

First, extract the necessary starting figures from the MI pack's Balance Sheet and Profit & Loss files.

- **From the Balance Sheet:**
  - **Total Investments:** The starting value for all investment assets.
  - **Cash at Bank:** The total cash holdings.
  - **Reinsurance Recoverables:** The total expected recoveries from reinsurers, which is the best estimate of reinsurance technical provisions.
  - **Technical Provisions (Gross and Net):** The value of Mulsanne's liabilities to policyholders.
  - **Receivables from Intermediaries:** Needed for Type 2 counterparty risk.
- **From the Profit & Loss:**
  - **Gross Earned Premium (Current & Prior Year):** Needed to calculate operational risk and the premium volume measure for underwriting risk.
  - **Net Written Premium:** Used in the calculation of the Minimum Capital Requirement.

2. Modelling Process: Calculating the SCR Modules

The core of the model involves calculating a capital charge for each major risk category. The total of these, after allowing for diversification, forms the Basic Solvency Capital Requirement.

Market Risk Module

This module quantifies the risk of loss from movements in financial market variables. Will need detailed asset breakdown from the Mulsanne manual (the MI pack only has totals).

- **Interest Rate Risk:**
  - **What happens:** The model calculates the impact of a sudden change (up and down) in interest rates on the company's net assets (Assets - Liabilities).
  - **Inputs:**
    - Asset cash flows from bonds and loans (from Mulsanne's asset list).
    - Net liability cash flows (derived from **Technical Provisions** in the MI pack, distributed over time using the payment patterns in the Mulsanne manual).
  - **Calculation:** The model discounts these cash flows under a "shock up" and "shock down" interest rate scenario. The SCR is the larger of the two resulting losses in net asset value.
- **Spread Risk:**
  - **What happens:** Calculates the risk of loss from credit spreads widening on bonds and loans.
  - **Inputs:** The list of bonds, mortgages, and loans from Mulsanne's asset list, along with their duration and credit rating.
  - **Calculation:** For each asset, the SCR is `Market Value × Duration × Risk Factor (based on rating)`. Unrated assets with a duration under 5 years use a 3% risk factor.
- **Equity Risk:**
  - **What happens:** Calculates the risk of loss from a fall in equity prices.
  - **Inputs:** The list of equity holdings from Mulsanne's asset list.
  - **Calculation:** The model applies a sharp downward shock to the value of the equities. The shock is typically **39% for Type 1** (developed market) equities and **49% for Type 2** (private/emerging market) equities. A **22%** shock is used for approved strategic investments. The final charge combines the results using a specific correlation formula.
- **Currency Risk:**
  - **What happens:** Calculates the risk of loss from adverse foreign exchange rate movements.
  - **Inputs:** The value of assets and liabilities denominated in foreign currencies (USD assets from Mulsanne's list) and the value of any hedges like forward contracts.
  - **Calculation:** The SCR is **25%** of the net exposure (Assets - Liabilities - Hedges) in each currency.
- **Concentration Risk:**

- **What happens:** Calculates the risk of being over-exposed to a single issuer of bonds or equity.
- **Inputs:** The full list of investment assets.
- **Calculation:** The model identifies all exposures to a single counterparty that exceed a threshold (**1.5%** of the total asset portfolio for non-rated investments). A capital charge is calculated on the excess amount for each, and the results are aggregated.

Counterparty Default Risk Module

This module quantifies the risk of loss if a third party defaults on its obligations.

- **Type 1 Risk (primarily Reinsurance):**
  - **What happens:** Calculates the loss if reinsurers fail to pay their share of claims.
  - **Inputs:** The **Reinsurance Recoverables** from the MI pack (broken down by reinsurer as in the Mulsanne manual) and the result of the underwriting risk calculation.
  - **Calculation:** A Loss-Given-Default is calculated for each reinsurer. It's based on the amount they owe plus a portion of the risk mitigation they provide, reduced by any collateral held.
- **Type 2 Risk (primarily Intermediaries):**
  - **What happens:** Calculates the loss if intermediaries (brokers) fail to pay the premiums they've collected.
  - **Inputs: Receivables from intermediaries** from the MI pack. Would also need an aging analysis (how many are overdue by more than 3 months).
  - **Calculation:** The SCR is `90%` of receivables overdue by more than 3 months plus `15%` of other receivables.

Note: **Type 2 Counterparty Risk** requires receivables to be split into two groups:

- Receivables from intermediaries that are **overdue by more than three months**.
- All other Type 2 exposures (including receivables due within three months).

The MI pack's BS provides a single, total figure for "Amounts due from Intermediaries". It does not contain the aging breakdown necessary to apply the different risk weightings (90% for overdue, 15% for others). The manual confirms that this data is sourced separately, stating, "A periodical aging debtors study is received to calibrate which debtors are or not on credit terms".

Non-Life Underwriting Risk Module

This module quantifies the risk that premiums and reserves are not sufficient to cover future claims.

- **Premium & Reserve Risk:**
  - **What happens:** This is the core underwriting risk, covering volatility in claims.
  - **Inputs:**

- **Net Technical Provisions** from the MI pack.
        - **Gross Earned Premium** (from PL) and planned premiums for the next year.
  - **Calculation:** The SCR is calculated as `3 × σ × V`, where **V** is a "volume measure" based on the larger of future or past premiums plus the net technical provisions, and **σ** is a standard deviation factor specific to each line of business (e.g., 8%-10% for motor).

Operational Risk Module

This module quantifies the risk of loss resulting from inadequate or failed internal processes, personnel, or systems, or from external events. The calculation is capped relative to the company's overall risk profile (the BSCR).

- **Inputs:**
    - **Gross Earned Premium (current year & prior year):** Sourced from the `PL` file.
    - **Gross Technical Provisions (non-life):** Sourced from `BS` file.
    - **The BSCR:** The diversified sum of the Market, Counterparty, and Underwriting risk modules, calculated in the preceding step of the model.
- Calculation:
    1. **Calculate the Premium-Based Component (`Op_Prem`):** This step calculates a value based on the insurer's earned premiums and its recent growth.
        - **Formula:** `Op_Prem = 3% × GEP_CY + Max[0, 0.3% × (GEP_CY - 1.2 × GEP_PY)]`.
        - This means the model takes **3% of the gross earned premium from the last 12 months** and adds a small additional amount if premium volume has grown by more than 20% compared to the prior year, capturing the operational risk associated with rapid growth.
    2. **Calculate the Provisions-Based Component (`Op_Prov`):** This step calculates a value based on the size of the insurer's technical provisions.
        - **Formula:** `Op_Prov = 3% × Max(0, TP_Non-Life)`.
        - For a non-life insurer, this is **3% of the gross non-life technical provisions**.
    3. **Determine the Final SCR:** The model then combines these values with the BSCR.
        - **Formula:** `SCR_Operational = Min(0.3 × BSCR, Max(Op_Prem, Op_Prov))`.
        - The logic is to first take the **larger** of the premium-based and provisions-based components. This result is then compared to **30% of the BSCR**. The final Operational Risk SCR is the **smaller** of these two figures.

3. Model Output

After running all the calculations above, the model will produce:

1. **The Basic Solvency Capital Requirement (BSCR):** This is the aggregated capital requirement for Market, Counterparty, and Underwriting risk, after accounting for diversification benefits between them using a standard correlation matrix.

2. The Final Solvency Capital Requirement (SCR): This is the final output. It's calculated as:

SCR = BSCR + Operational Risk SCR + Any Capital Add-ons

The final SCR figure is the model's primary output. It represents the total amount of capital the insurer needs to hold to ensure there is a 99.5% probability that it can meet all its obligations to policyholders over the next 12 months.