1. Collect sensitivities from “Sensitivities and weights” sheet. Sensitivities are in “GIRR Sensitivities” sheet for each tenor.
    a) Column B, Currency = Currency bucket. Currently there are 2 buckets in this sheet USD and EUR.
    b) Column C, Tenor = Tenor of GIRR
    c) Column D, Sensitivity: sensitivity at that tenor.

2. **Currency bucket:** Create currency buckets with tenors: You will create 2 currency buckets because there are only 2 currencies in this sheet. You will aggregate all tenor 1 currencies in one single bucket of distinct currency and 2nd bucket will aggregate all respective tenors. In the end Currency A will have all aggregated tenors and same with currency B.
3. **Risk weights:** Collect Risk weights from sheet “GIRR weights” for each tenor. These are in % so you need to multiply them by 0.01
4. **Weighted sensitivity:** Calculate at all tenors by multiplying Risk weights by sensitivity
   $WS_k = RW_k S_k$
5. **Medium tenor correlation:** Collect base correlations between tenors within same currency bucket from sheet “Correlations”
6. **High tenor Correlations**: Based on collected base correlations, calculate correlation matrix of high correlation scenario. For this just multiply all correlations by 1.25. Correlations should be capped at 100%
7. **Low tenor Correlations**:
   Adjust each tenor correlation in Medium correlation with below formula
   $$\rho_{kl}^{low} = \max(2 \times \rho_{kl} - 100\%; 75\% \times \rho_{kl})$$

8. **Aggregate** tenors within currency buckets for netting. 1 Year sensitivities should add and same applies to all tenors
9. **Bucket Capital(Kb):** Calculate 3 bucket aggregations(for 3 tenor correlations above) using below formula for both currency buckets. Only Correlations change; Weighted sensitivities stay same.

$$K_b = \sqrt{max(0, \sum_k WS_k^2 + \sum_k \sum_{k \neq l} \rho_{kl} \times WS_k \times WS_l)}$$

    a) **Low correlation bucket capital:** Use Low correlation scenario and weighted sensitivities at tenors
    b) **Medium correlation bucket capital:** Use Medium correlation scenario and weighted sensitivities at tenors
    c) **High correlation bucket capital:** Use High correlation scenario and weighted sensitivities at tenors

   So for each bucket you will get 3 bucket values and for 2 buckets in total 3*2 = 6 bucket values.

10. **Get inter-bucket correlation(γ_{bc})-**Read sheet "Misc Weights" row . γ_{bc}Read column Correlation%. Remember this is in %

a) **Medium inter-bucket correlation:** γ_{bc}

b) **High inter-bucket correlation**: Multiply $\gamma_{bc}$by 1.25. Correlation should be capped at 100%

c) **Low inter-bucket Correlations**:
Use below formula

$$\gamma_{bc}^{low} = \max\left(2 \times \gamma_{bc} - 100\%; 75\% \times \gamma_{bc}\right)$$

11. **Across bucket aggregations:**
We will do this step 3 times.
Low correlation iteration: Use Low correlation bucket capital charge and low interbucket correlation
Medium correlation iteration: Use Low correlation bucket capital charge and low interbucket correlation
High correlation iteration: Use Low correlation bucket capital charge and low interbucket correlation.

In all these 3 iterations Bucket aggregate sensitivity step will be same so feel free to perform only once. Next 2 steps of GIRR delta capital charge will be done 3 times(low, medium, high) and Recalculation of S_b will also be done thrice(low, medium, high). Weighted sensitivities remain same.

a) **Bucket aggregate sensitivity** within each bucket by simple summation, i.e. by below formula

$$S_b = \sum WS_k$$
$$S_c = \sum WS_k$$

b) ***GIRR Delta capital charge*** *as below formula.*

$$\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c$$

Apply sqrt to above calculated number.
If Delta capital charge is –(ve) then go to below extra step. Capital cannot be –(ve)

c) If the sum in step (b) above gives -ve number use alternative approach as below.

I. ReCalculate S_b (Bucket aggregate sensitivity)for bucket "b"

$$\boldsymbol{S_b = max[min(\sum_k WS_k, K_b), -K_b]}$$

For bucket c

$$S_c = max[min(\sum_k WS_k, K_c), -K_c]$$

II. **And recalculate GIRR Delta capital charge**:

$$\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} S_b S_c$$

12. **All the metrics calculated above must be transported in excel document. We will need 3 metrics:**
    a) Low correlation GIRR Delta capital charge
    b) Medium correlation GIRR Delta capital charge
    c) High correlation GIRR Delta capital charge

Result: Bucket offsetting exposures resulted in High capital charge for low correlation scenario and low capital charge for high correlation scenario