2.

```
normal distribution's ES and VaR: 0.11411909995199543 0.09117937291393813
t distribution's ES and VaR: 0.11321754783001671 0.07647567473961198
historical's ES and VaR: 0.11677669788562187 0.07598069069686242
```

Normal Distribution:

- **VaR (0.0912)**: The Value at Risk is relatively higher under the normal distribution compared to the t-distribution and historical simulation. This is because the normal distribution underestimates the probability of extreme events due to its thinner tails.
- **ES (0.1141)**: The Expected Shortfall is slightly higher than VaR, as ES captures the average of losses beyond the VaR threshold. Since the normal distribution doesn't account for heavy tails, ES is relatively stable but less reflective of extreme outcomes.

t-Distribution:

- **VaR (0.0765)**: The t-distribution has heavier tails, which better capture extreme events. As a result, the VaR is lower compared to the normal distribution, indicating a higher probability of extreme losses.
- **ES (0.1132)**: The Expected Shortfall remains close to the normal distribution but is slightly lower. This reflects the t-distribution's ability to account for more extreme tail events beyond the VaR threshold.

Historical Simulation:

- **VaR (0.0760)**: The historical VaR closely resembles the t-distribution because it is based on actual past data, which may include extreme events and thus reflects heavier tails.
- **ES (0.1168)**: Historical ES is slightly higher than both the normal and t-distribution ES, as it captures real-world extreme events that the t-distribution and normal assumptions might smooth out.

3.

```
Matrix is PSD
  Portfolio       VaR95       ES95
0         A  284.215631  452.511016
1         B  263.813085  485.216943
2         C  240.263412  327.148191
  Portfolio       VaR95       ES95
0         A  363.514921  521.586983
1         B  310.675217  549.091157
2         C  265.069550  378.084199
```

Magnitude of VaR and ES Values:

- **Last Week's VaR (Problem 3)** values are significantly higher than the simulated VaR and ES values from this week.
    - This could be due to differences in the confidence level (97%) and methodology (historical vs. simulated).
    - The historical VaR directly uses past data, capturing real-world extreme events, which might lead to higher values.
- **Current Simulated VaR and ES** values are lower, possibly because the simulation smoothens extreme events and depends on the estimated covariance matrix or PCA simulation.

Consistency in Ranking:

- Across both weeks, **Portfolio A consistently has the highest VaR**, followed by Portfolio B and then Portfolio C.
- This suggests that Portfolio A is the riskiest among the three portfolios, regardless of methodology.

Historical vs. Simulated VaR:

- **Historical VaR (Problem 3)** tends to produce higher risk values because it directly accounts for extreme past losses.
- **Simulated VaR (This Week)**, based on PCA and covariance matrix methods, smoothens tail risks, leading to slightly lower VaR values.

ES95 (Expected Shortfall):

- Current **ES** values are higher than their respective VaR values, reflecting that ES captures the average loss in the tail beyond the VaR threshold.
- Last week's results do not include ES for comparison.

Impact of Covariance Matrix:

- The **covariance matrix-based VaR and ES** are higher than the PCA-simulated values. This difference indicates that using the covariance matrix directly might better capture overall portfolio risk compared to PCA-reduced simulations.