Question 8 Caracterizing the five data sets.

1) A small map with four landmarks
relativily simple, no need for extra modifications.

2) A larger, denser map but less noise
relativily simple, no need for extra modifications.

3) A small map with five landmarks
One main problem for this problem are cycles, i.e situations where certain feature m_j are seen iat drastically different time steps x_t2 and x_t2. When this is the case no more linear time complexity for the information matrix inversion holds.

4) Here the noise is so large and there are so many outliers such that one can not get convergence without modifications to the approach

The noise problem as above can be tackeled by increasing the covariance matrix. The direct problem of that is that the more one increases the covariance the more ill conidtioned the information matrix becomes. Especially for our gauss-newton gradient this corresponds to very big changes from one iteration to the other. One solution to increase the numerical stability for this would be using square root form.

Another problem with cases with very high noise is linearization. The higher the noise the bigger will the linearization error will be.

The two facts above make this case the most difficult of all 5 cases we deal with.
We solve this case by usage of outlier detector and iterative deepening which is very important for the outlier detector to work as it requires a relatiely good estimate of the initial before rejecting outlier measurements. Otherwise it would reject non-outlier measurements.

5) Here there is no odometry at all so the initial estimate can not be made beyond the features seen at the start and since the covergence toward a good local minima depends heavily in the startpoint it is very important that one tackles this problem correspondly. For that reason it is important that one does iterative deepening with very small steps. In that way we make sure that we gradually get a better initial estimate for the final equation. Obviously single outliers would cause the whole approach to fail so it is important in the same time that there is a certain outlier rejector running at the same time.