Answer 1.

- HELP, NGO is focused on battling destitution and furnishing the general population of in backward nations. They want help those countries by giving $ 10 million in total.
- Identify parameters/variables that significantly indicates the need for nations of funds. Through these parameters we can identify 5 countries
- We achieve this by PCA and clustering.
- PCA: The main criterion for choosing 5 components is that they should cover more than 80% variance. These 5 components should be performed on normalized data and after removal of outliers.
- Clustering: K-Means- Draw silhouette and elbow curve to check for which value of K we will get useful Info. From here we get K=5. From here draw various plots to check relations between clusters.
- Check this clustering with Hierarchical method. From here we will get 5 clusters after dendrogram.
- After analyzing both methods, we found that hierarchical is better as it gives better variance between clusters.
- We further do analysis by comparing different countries with averages of each columns.
- countries to be aided are :
  - Congo, Dem. Rep.
  - Burundi
  - Niger
  - Liberia
  - Central African Republic

Answer 2. Three drawbacks are:

1. Scale variant – PCA doest not normalize and scale data itself. That means that if we change the scale of some of the variables in data set, we will get different results by applying PCA.
2. Large variance = Low covariance = High importance.
   - If you want to compress or remove noise from your dataset this assumption is an advantage
   - PCA assumes that columns with low variance are not useful, which might not be true in prediction setups For example Blind Source Separation, it is not useful.
   - As stated in Independent Components Analysis**.** Uncorrelated is only partly independent.
3. PCA is limited to linearity and that may not be the best solution for some cases and hence won't work in non-linear model

Answer 3.

- Means clustering can handle big data as opposed in hierarchical clustering.
- Time complexity of K-Means is linear i.e. O(n) and for hierarchical clustering its quadratic i.e. O(n2).
- Results are reproducible in Hierarchical clustering upon running multiple times. But, in K Means, since we start with random choice, the results differ every time we run it.
- In hierarchical clustering, by interpreting the dendrogram we can choose K values. But in K Means clustering, prior knowledge of K is required i.e. no. of clusters you want to divide your data into.
- Hierarchical clustering requires more computational power than K-means because of distance calculation with each element