You are given a 3-dimensional dataset, stored in BeamPattern.mat, containing an artificial (randomly-generated) satellite beam radiation pattern over Iran. The entire coverage area ranges from 26 to 41 in latitude and from 45 to 60 in longitude. The beam pattern consists of 16 beams each corresponding to one slice in the 3rd dimension of the BeamPattern array. For example, the data stored in BeamPattern(:,:,4) corresponds to the 4th beam. The structure of the data in each slice is as follows:

- Each slice has 22801 rows and 4 columns.
- Each row corresponds to one single point on Earth.
- The first and second columns contain the latitude and longitude coordinates of the point, respectively. The third and fourth columns, respectively, contain the beam gain (in dBi) and beam phase (in degrees) for each point.

You are supposed to perform the following tasks:

1. Calculate the 3dB region for each beam and plot them in a single figure for all 16 beams. You can use the geoshow function as geoshow('landareas.shp') with appropriate x & y limits to show the land areas in the background.

2. Find the beam center for each beam and show it on the figure of task 1.
   Hint: The beam center refers to the point with maximum beam gain among the others.

3. Randomly generate latitude and longitude coordinates for 8 on-ground user terminals (UTs) and assign each UT to one beam based on a minimum geographical distance criterion.

   Hint: Given the latitude and longitude coordinates of two points, denoted by [lat_1,lon_1] and [lat_2,lon_2], the geographical distance between them can be calculated as

   $$d = R * \text{acos}\big(\cos(lon\_1 - lon\_2) * \cos(lat\_1) * \cos(lat\_2) + \sin(lat\_1) * \sin(lat\_2)\big)$$

   where R = 6374000 is the Earth radius in meters and the latitude and longitude coordinates are in radians. Also, show the UTs (with a different marker than those of the beam centers) on the figure plotted in task 1.

4. Assuming that the satellite has the same number of feed antenna elements as the number of beams (16 in our case), calculate the 8-by-8 complex channel matrix for the generated set of UTs.
   Hint: Assume that, with 8 UTs, only those 8 feed antennas corresponding to the UT's assigned beams are radiating.

5. For each UT, determine another UT that interferes with it the most (i.e., the UT with the highest interference power).

Please share with us your MATLAB codes for all the above tasks and the figure you generated with 3dB beam regions, beam centers and UTs plotted on it.