Practical round

7. Noon. An observer based in some city in Bangladesh monitored time of local noon on each day in the year 2012. In table 1, first column is serial number, second column is date of observation (**D**), third column is time of local noon (**T**) as per observer's clock and the last column is measured altitude of the Sun at local noon (**a**) in degrees. Bangladesh follows UT+6 hours timezone, and it is known that on 15th April every year, the mean sun's position matches exactly with the true sun. Use this data to find:

7.1. Longitude of the Observatory.

7.2. Latitude of the Observatory.

7.3. Use the given map of Bangladesh, to identify the city. Write the name of city exactly as given in the Map.

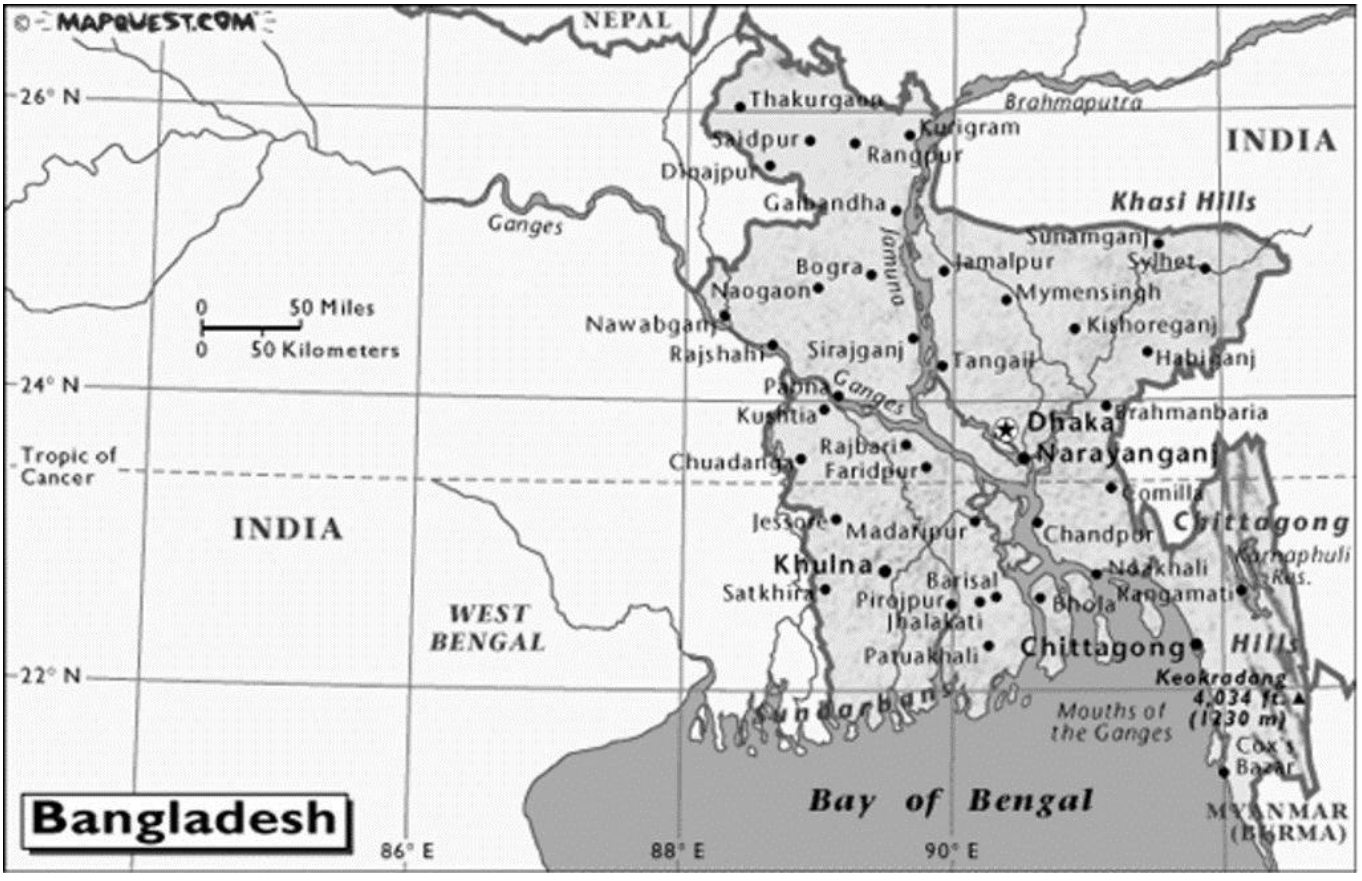
7.4. Draw a graph showing equation of time (EoT) correction required (in minutes) for each day.

7.5. Date on which the Sun culminates at the earliest and difference in minutes from local noon.

7.6. Date on which the Sun culminates at the latest and difference in minutes from local noon.

7.7. Dates apart from 15th April when the Sun culminates exactly at local noon.

Note: write all dates in DD.MM.YYYY format using Arabic numerals only.

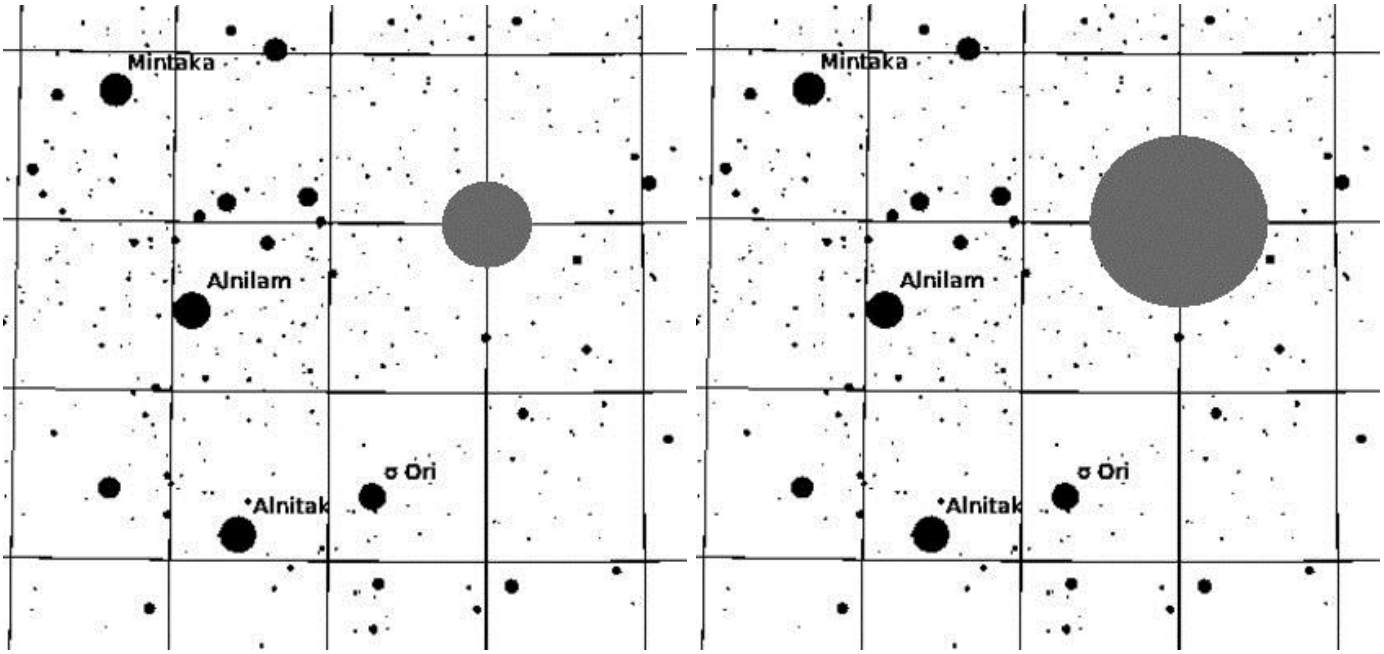


Practical round

8. The black cloud. In science fiction novel "The black cloud", written by Sir Fred Hoyle in 1957, an interstellar dark cloud is discovered approaching the solar system. We will try to retrace the steps explained in the novel to estimate motion of the cloud. Two photographs given below show a small region inside the constellation of Orion. The photographs are taken exactly 2 years apart. The grid in the image has the size of 1^o x 1^o.

8.1. In how many years (after the second image) the cloud will entirely cover the belt of Orion (seen on the left)?

8.2. In how many years (after the second image) the cloud will arrive at the Earth? Assume the cloud to have uniform velocity throughout the journey.





Practical round

8. Variable stars. An enthusiastic astronomer in Dhaka found the data given in table 2 about variable stars in Large Magellanic Cloud (LMC) from virtual observatory. In the table, first column is serial number of star, second column is its Right Ascension (α), third column is Declination (δ), fourth column is period of pulsation in days and last column is its observed magnitude (**m**).

8.1. Help the observer to classify the variables as classical Cepheids (C1), type II Cepheids (C2) and RR Lyrae stars (R). You should write these symbols in front of each star in the table. You may or may not use graph paper.

8.2. Period-luminosity relation for Cepheids takes the form $M = A \cdot \log_{10}(p) + B$, where M is absolute magnitude of the star and A and B are some constants. For LMC, find value of A and B for both types of Cepheids. You can assume distance of LMC as 48 kpc.

8.3. Identify foreground (mark "**F**") and background (mark "**B**") stars (if any) in the data.

8.4. Estimate distance to the stars which are not part of LMC.

Notes:

- Classical Cepheid stars are a type of pulsating variable stars, which show linear relationship between period of pulsation and absolute luminosity in a log-log plot.
- Type II Cepheid stars show exactly similar kind of relationship as classical Cepheids but are fainter than a classical Cepheids for a given period.
- RR Lyrae stars are another type of pulsating variable stars which show very short period (less than 1 day) of pulsation and for all RR Lyrae stars, the absolute luminosity is nearly constant.