AAiT
Addis Ababa Institute of Technology
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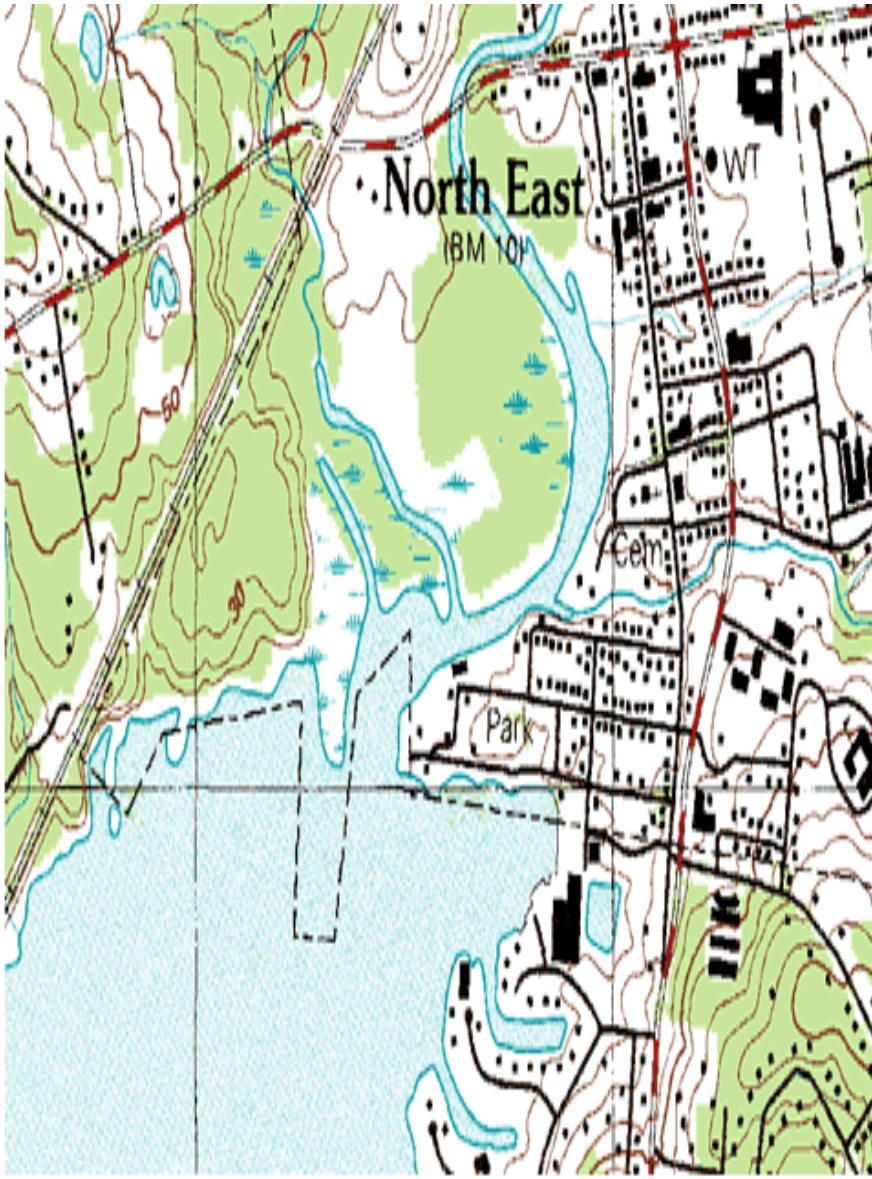
SCHOOL OF CIVIL AND ENVIROMENTAL ENGINEERING

Surveying II
CENG 2092

Chapter 2
Topographic Survey



Tamru T.

2012EC (2019/20GC)
2nd Sem

Topographic survey

- Made to determine the locations of natural and artificial features on the Earth's surface and to define the configuration (relief) of that surface.
- Then these features can be represented on maps.

Natural:

Vegetation, rivers, lakes, oceans, and so on

Artificial:

Roads, rail roads, buildings, bridges, canals, and so on

Relief:

Hills, valleys, plains, and other surface irregularities

Two different types of maps

- **Planimetric**
  - Dipicts natural and artificial features in the plan (X,Y) view only horizontal.
- **Topographic**
  - Include planimetric features but in addition they show the configuration of the Earth's surface.

Application of TM for different Disciplines

- Engineers and planners: suitable site for roads, pipelines ….
- Geologists: to investigate mineral oil, water
- Foresters: fire control routes, observation towers
- Architects: housing and landscape design

Methods of showing relief

- Contours: the most commonly used

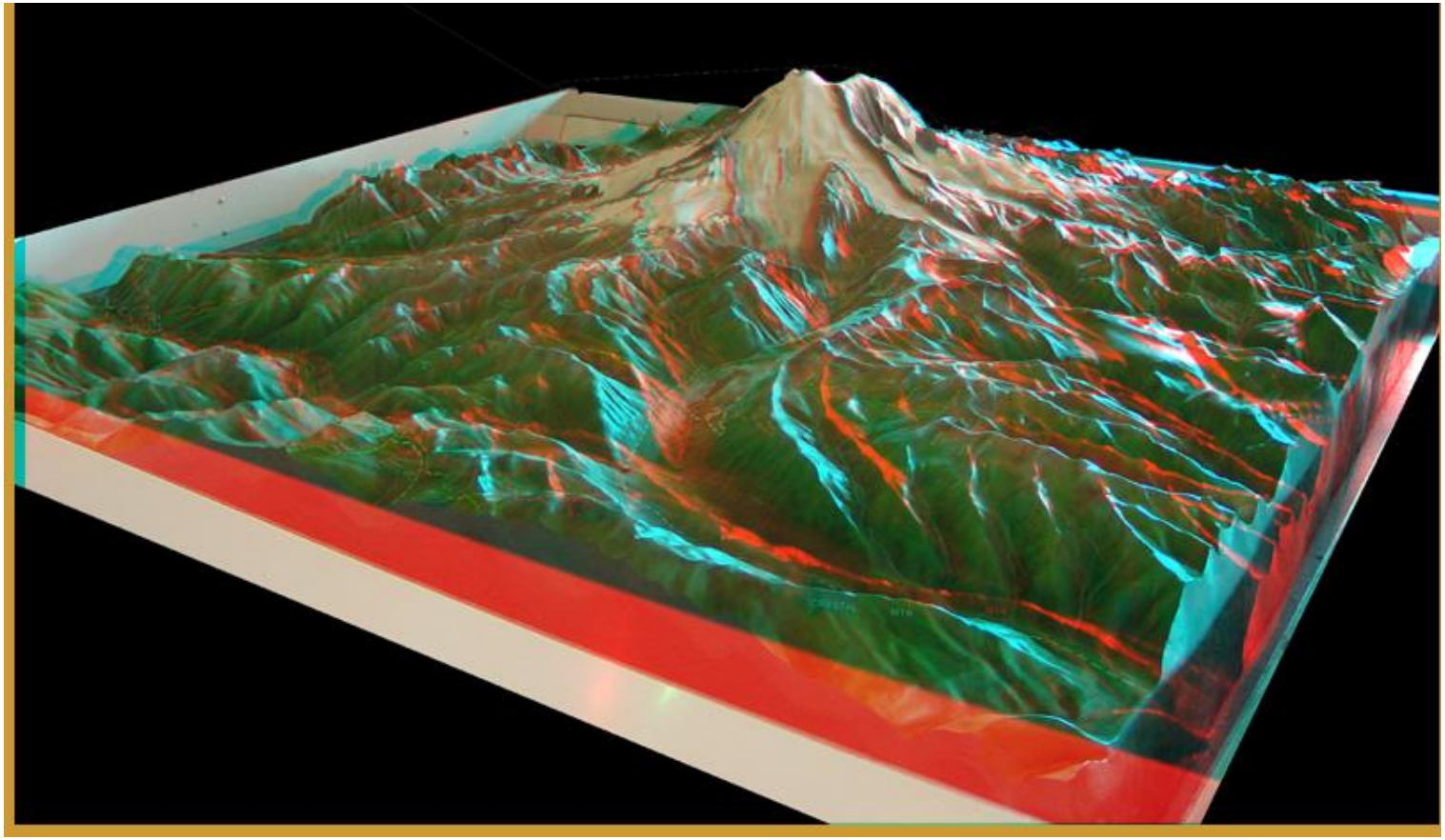
- Digital Elevation Model (DEM)
- Three Dimesional perspective models

Newer methods

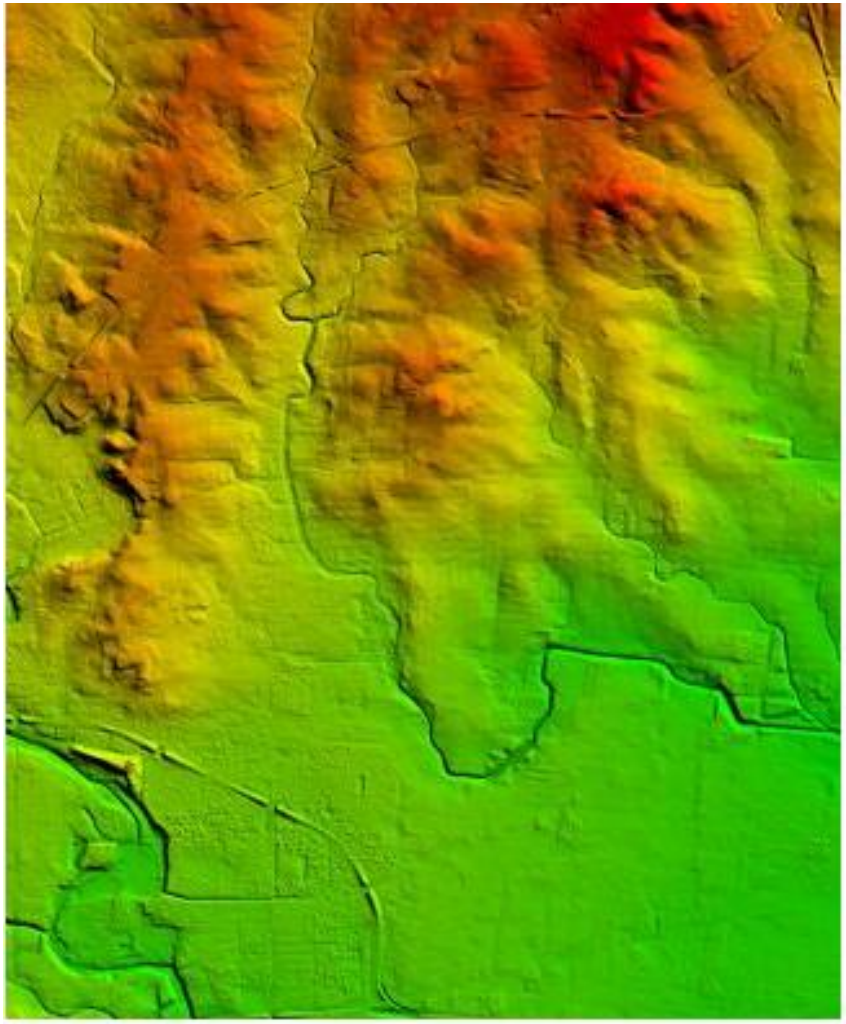
- Hachures
- Shading
- Tinting

Not quantitative enough, generally unsuitable for surveying and engineering work

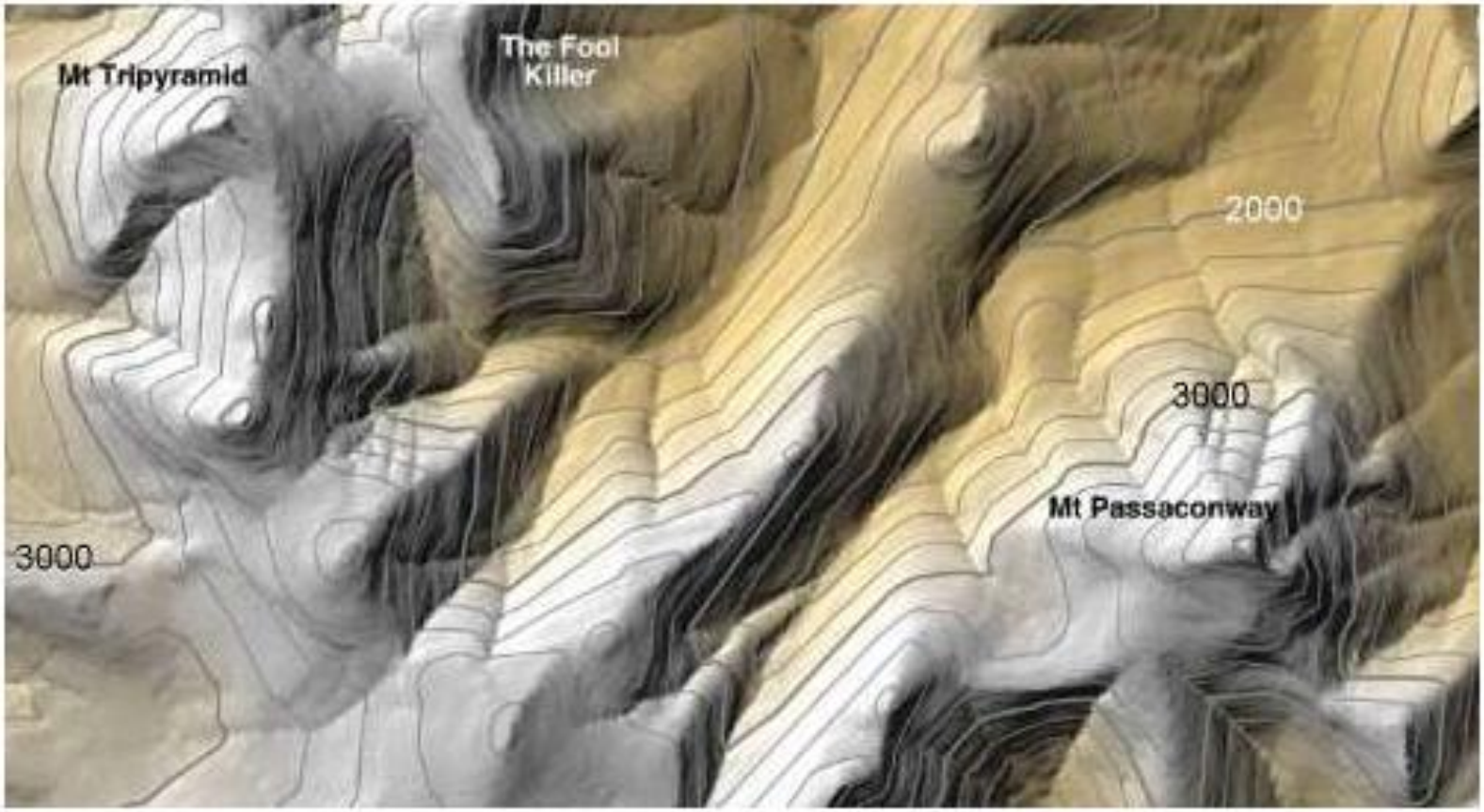
3D Model



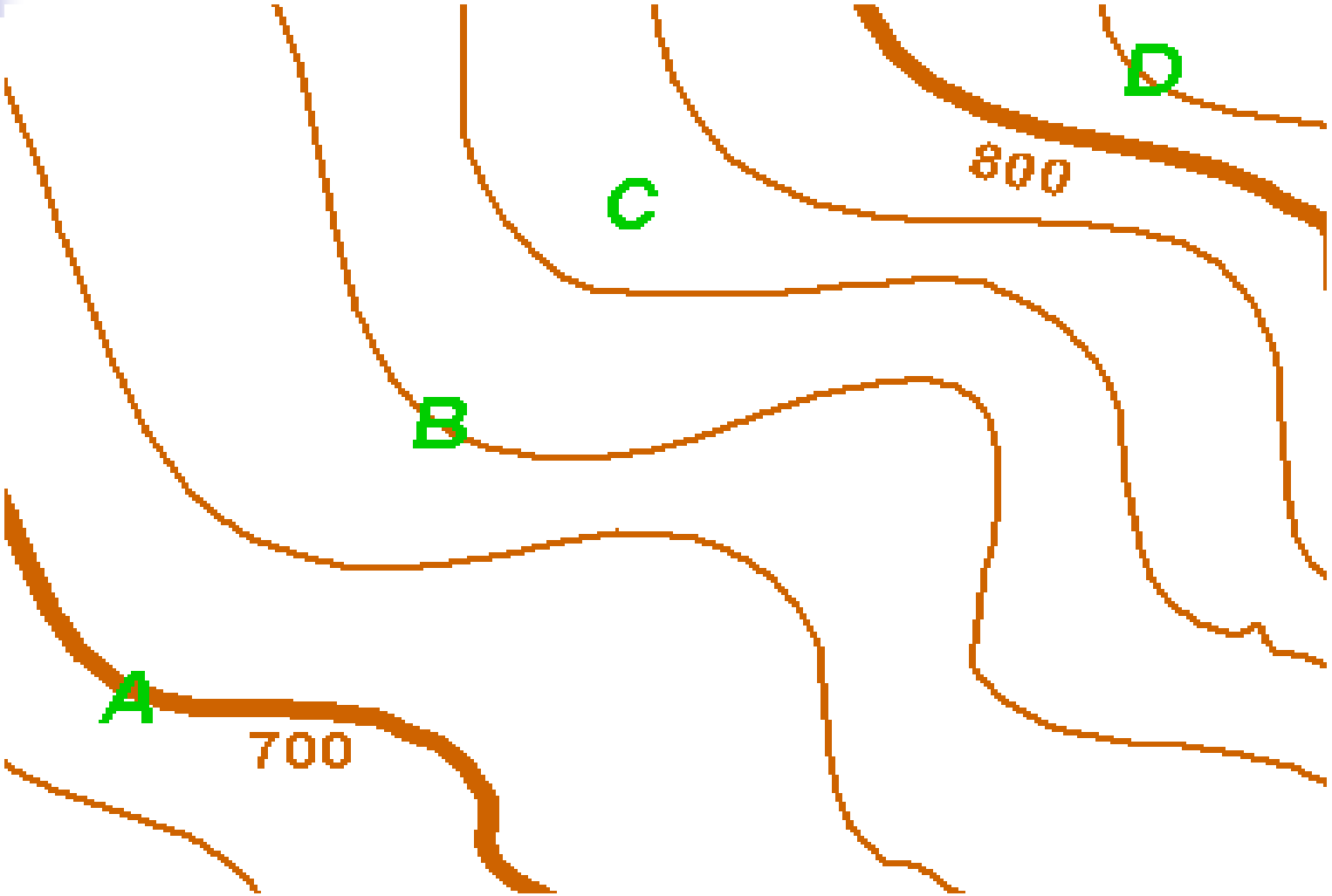
Digital Elevation Model



Shaded relief



Contour line



Methods of preparation of maps

- Manual drafting
- Computer, Computer Aided Drafting (CAD) software, and data collectors

Methods for performing topographic surveys

- **Aerial (Photogrammetric):** preferable for large areas.

- **Ground (field):** for small area.

  Necessary to establish control and field-check mapped features for accuracy.

Topographic surveing

Field work in topographic surveying divided in to two:

- Control establishment
  - horizontal and vetrical
- Detail surveying

Detail surveying

(1) All natural or artificial features that will appear on the map and

(2) Enough ground points and spot elevations to make the drawing of contour lines possible.

Map Drafting

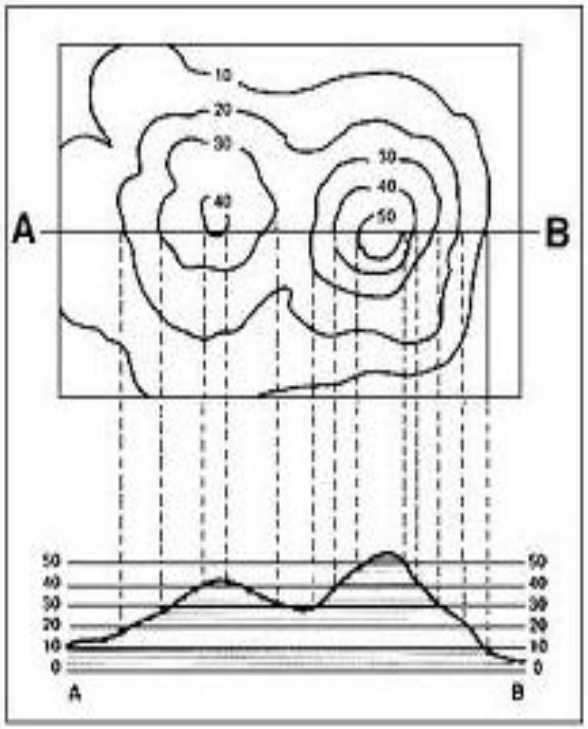
- Plotting the traverse
  - Plotting horizontal controls
    - Select Scale
    - Select convenient point from the first station
    - Show meridain or Zero angle line through this point.

Map Drafting Cont.....

- Measure the angle to second point
- Draw line through measured angle and measure the distance on that line.
- Second point is found
- Plotting the details
- Drawing the topography and special data
- Finishing the map

Contour Lines

- Contour is a line which connects points of equal elevation.
  - Zero Contour
  - Index contour
  - Intermidiate contour



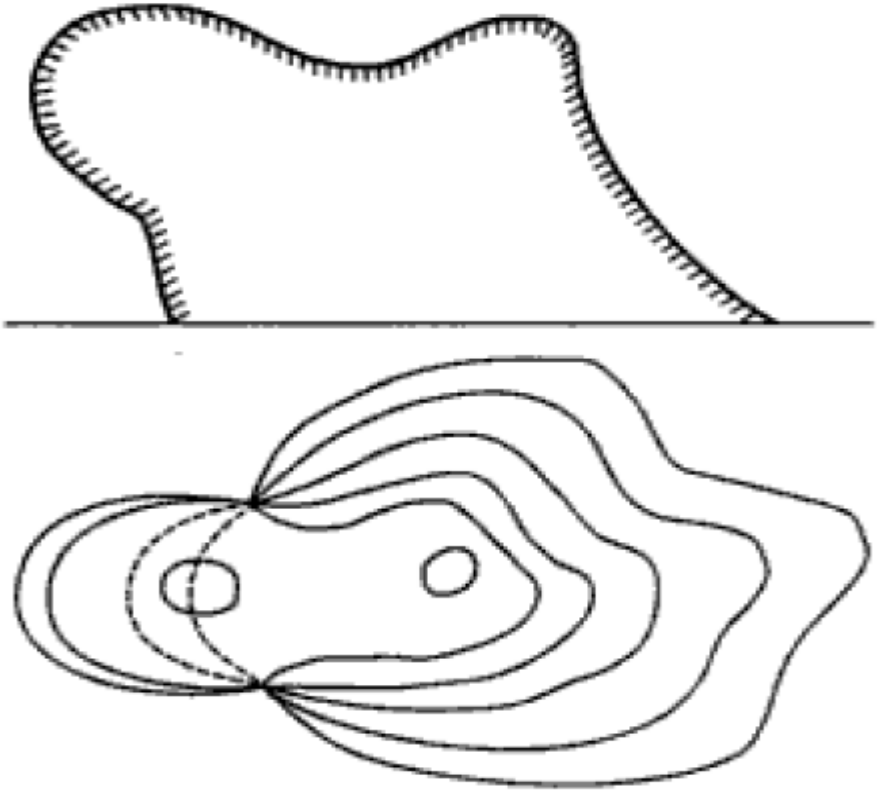
Contour Interval

- Depends up on
  - The nature of the terrain
  - The purpose of the survey
  - The extent of the survey
  - The scale of the map

The horizontal distance between two points on the consecutive contour lines for a given slope, is the ***horizontal equivalent***

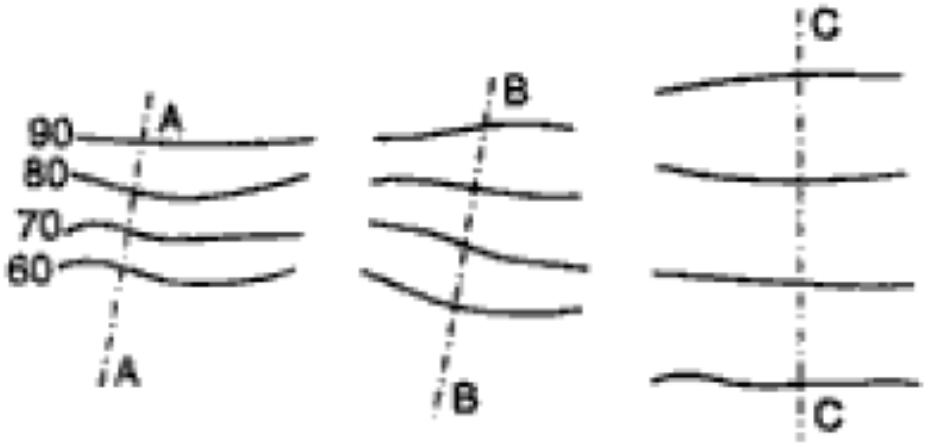
Contour characterstics

- Two contour lines of deferent elevations cannot cross to each other



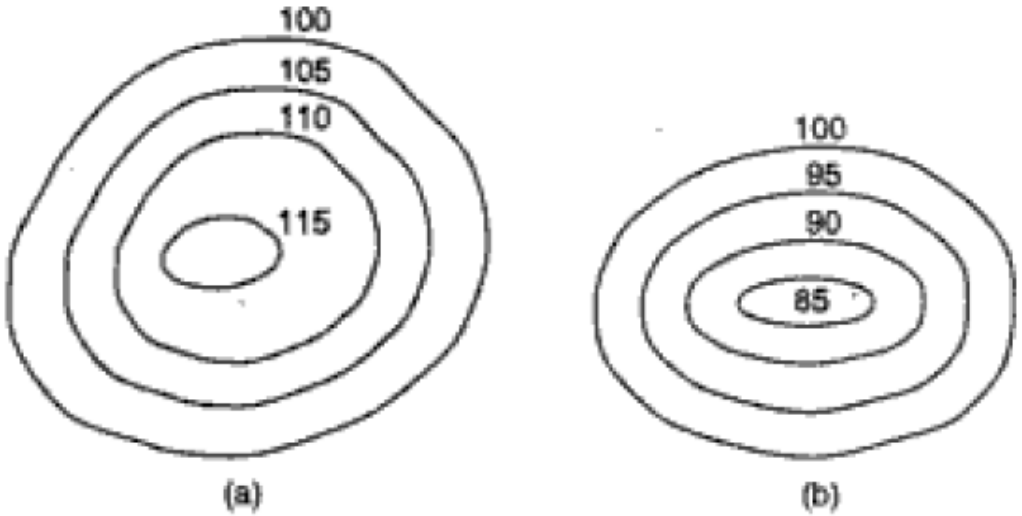
Contour charac.....

- Contour lines of different elevations can unite to form one line only in the case of vertical cliff.
- Closely spaced contour lines indicate steep slope.
- Widely spaced contour lines indicate gentle slope.
- Equally spaced contour lines indicate uniform slope



Contour charac.....

- Contour lines cannot begin or end on the plan
- A contour line must close itself but need not be necessary within the limit of the map.
- Depression and hills look the same. One must note the contour values to distinguish.

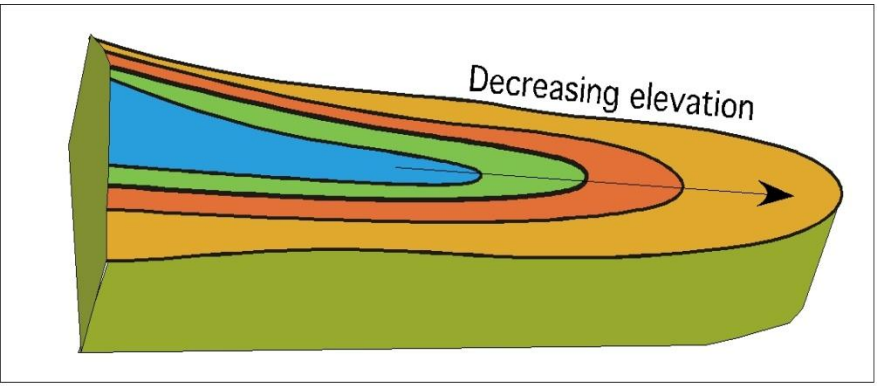


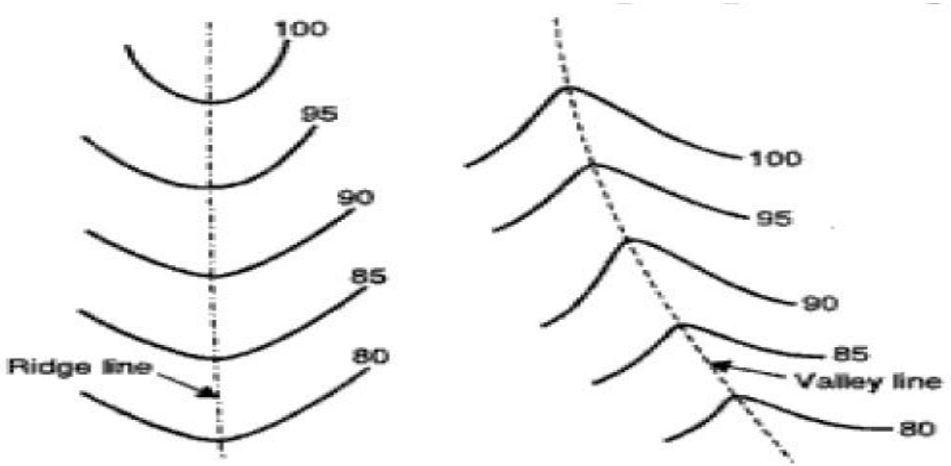
Contour charac....

- The same contour must appear on both sides of a ridge or valley
- Contours do not have sharp turnings
- A single contour lines cannot lie between two contour lines of higher or lower elevation

Contour charac....

- Contours deflect uphill at valley lines and downhill at ridge lines. Contour lines in U-shape cross a ridge and in V-shape cross a valley at right angles. The concavity in contours lines is towards higher ground in the case of ridge and towards lower ground in the case of valley.

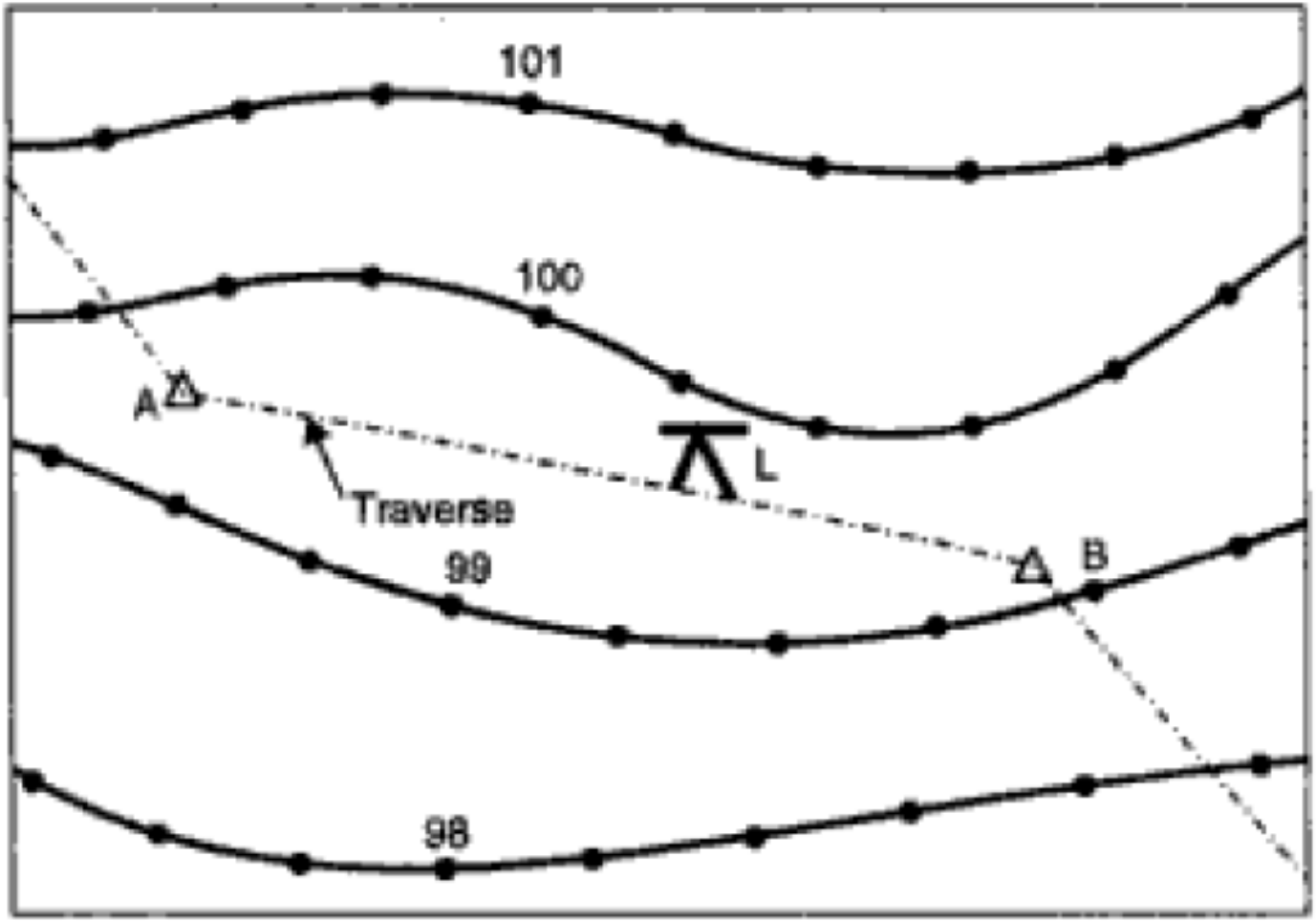




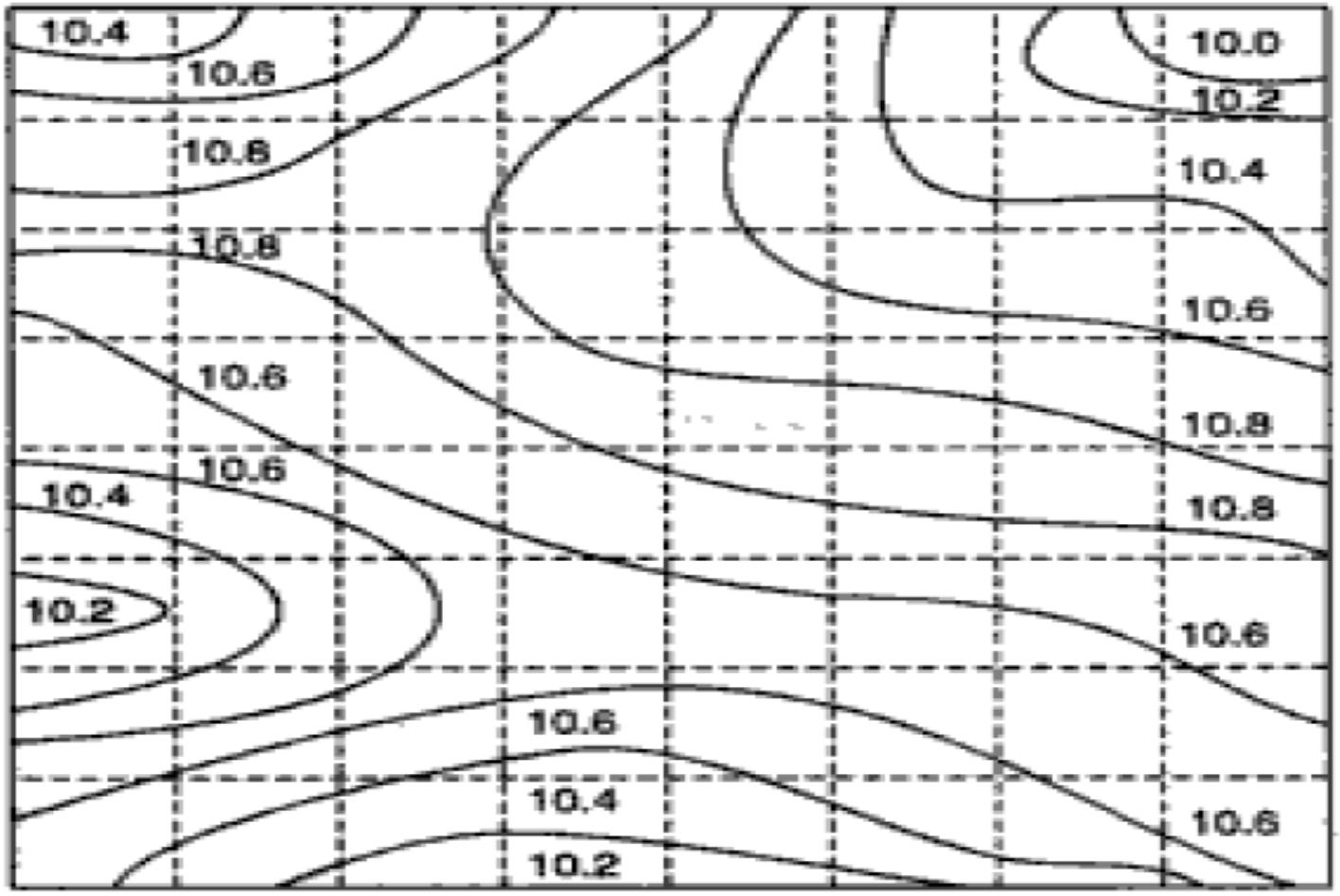
Methods of contouring

- Direct
- Indirect
  - Grid
  - Cross-section
  - Radial

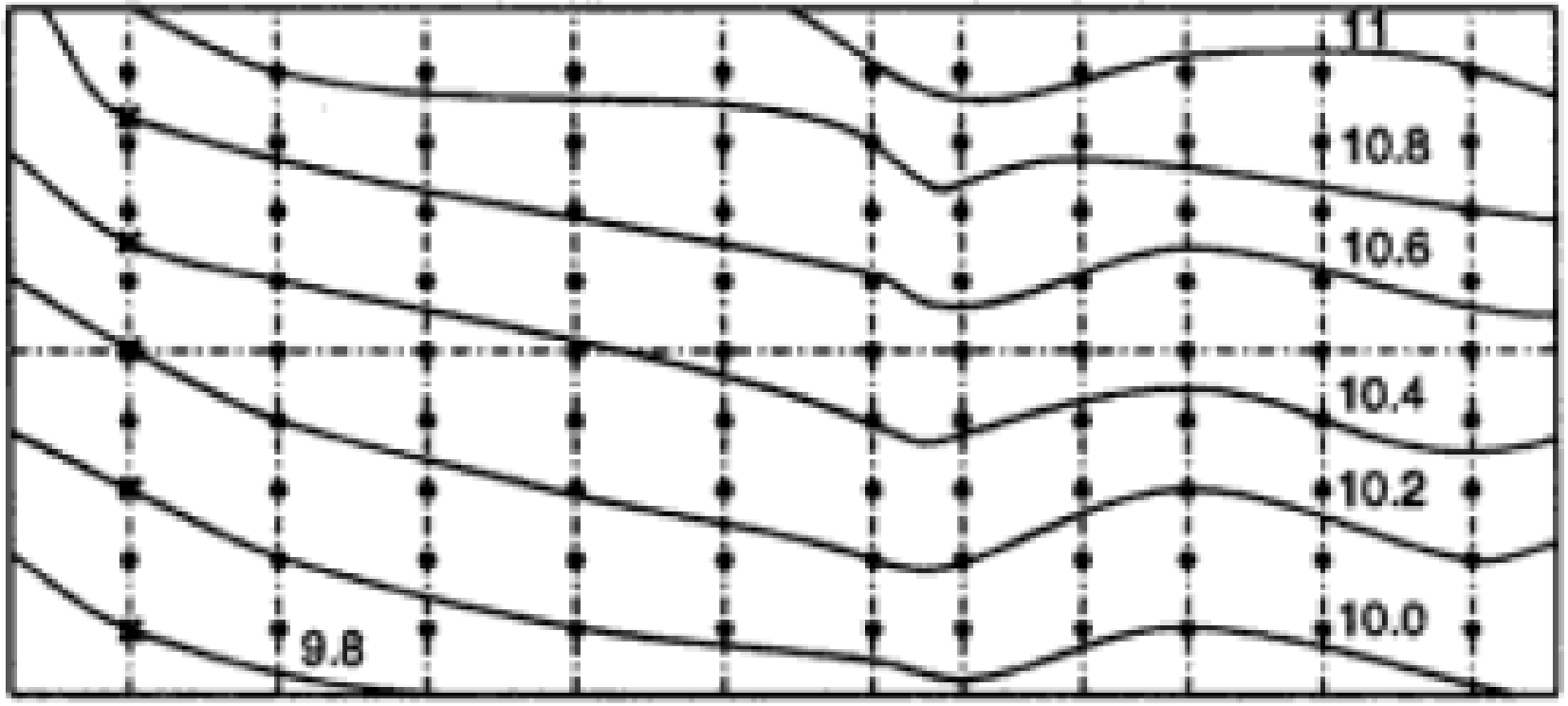
Direct



Indirect -Grid

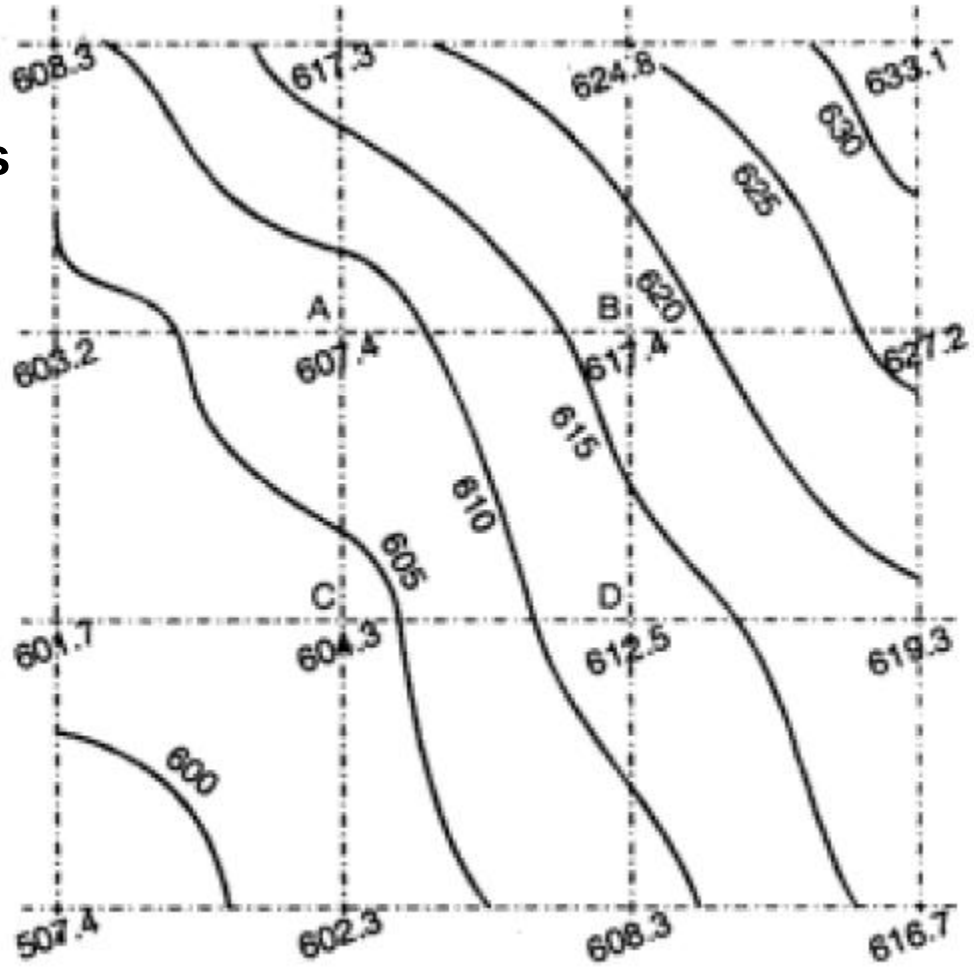


Indirect – Cross-section



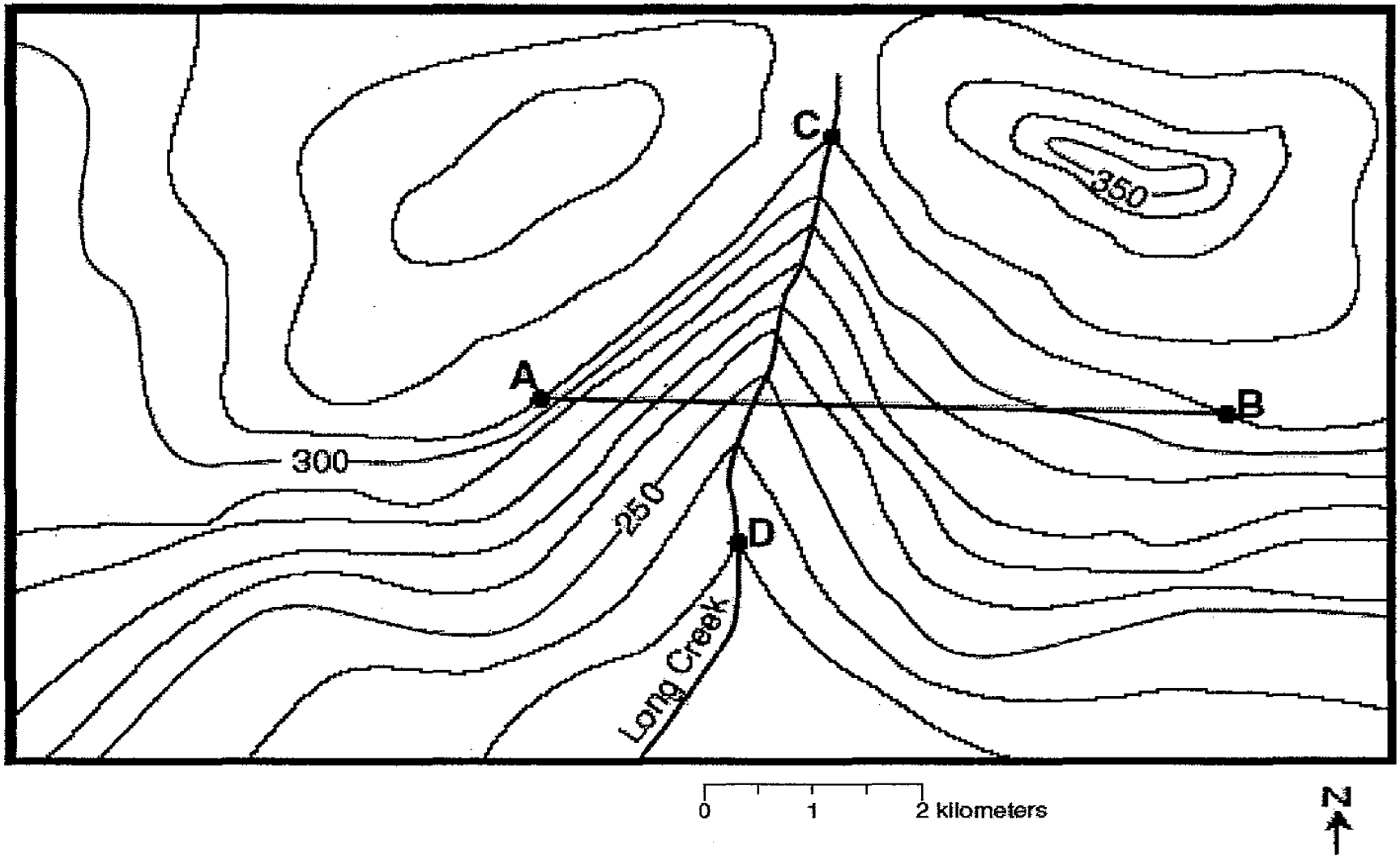
Interpolation of Contours

a) By estimation
b) By arithmetic calculations
c) By Graphical method



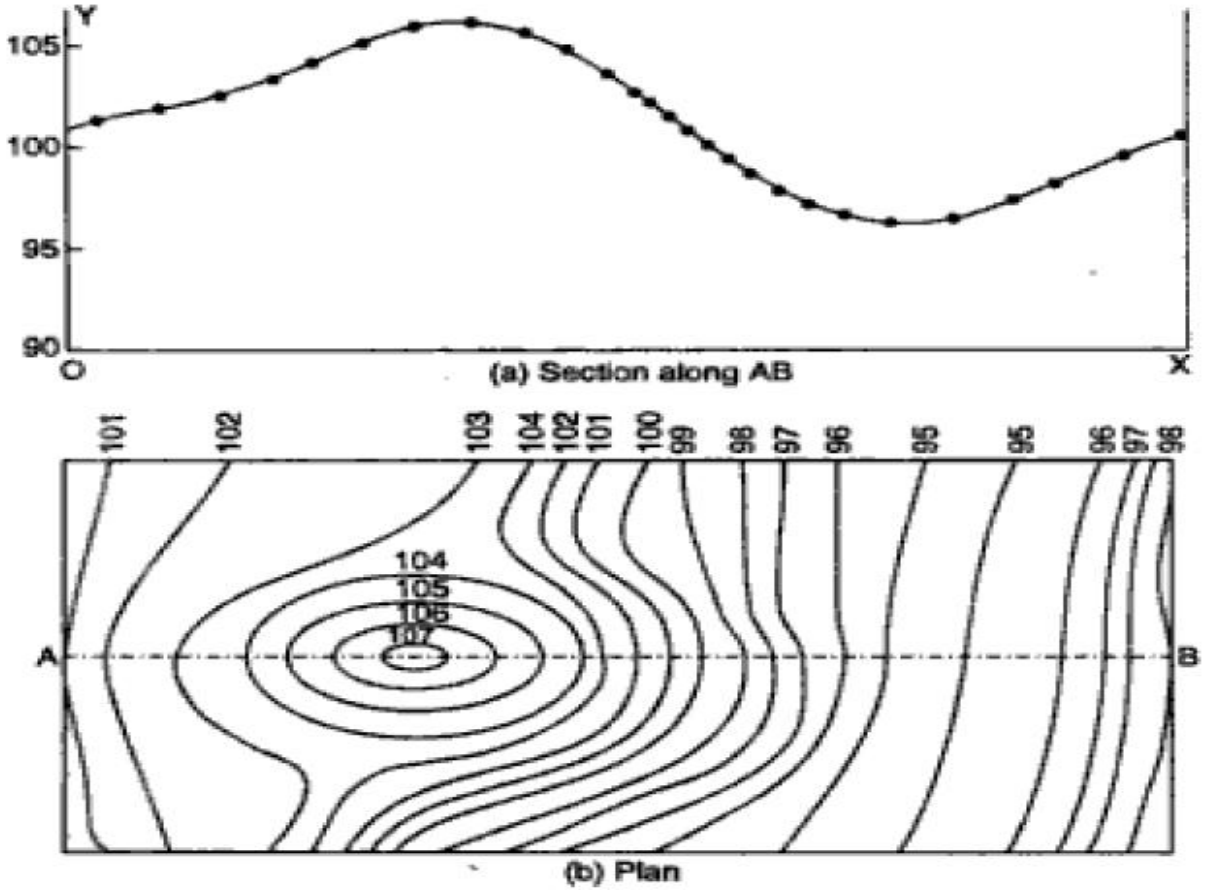
Contours Quiz

-Elevation of A,B,C& D
- Contour interval
- Gradient of A and B & C and D
- River flow direction



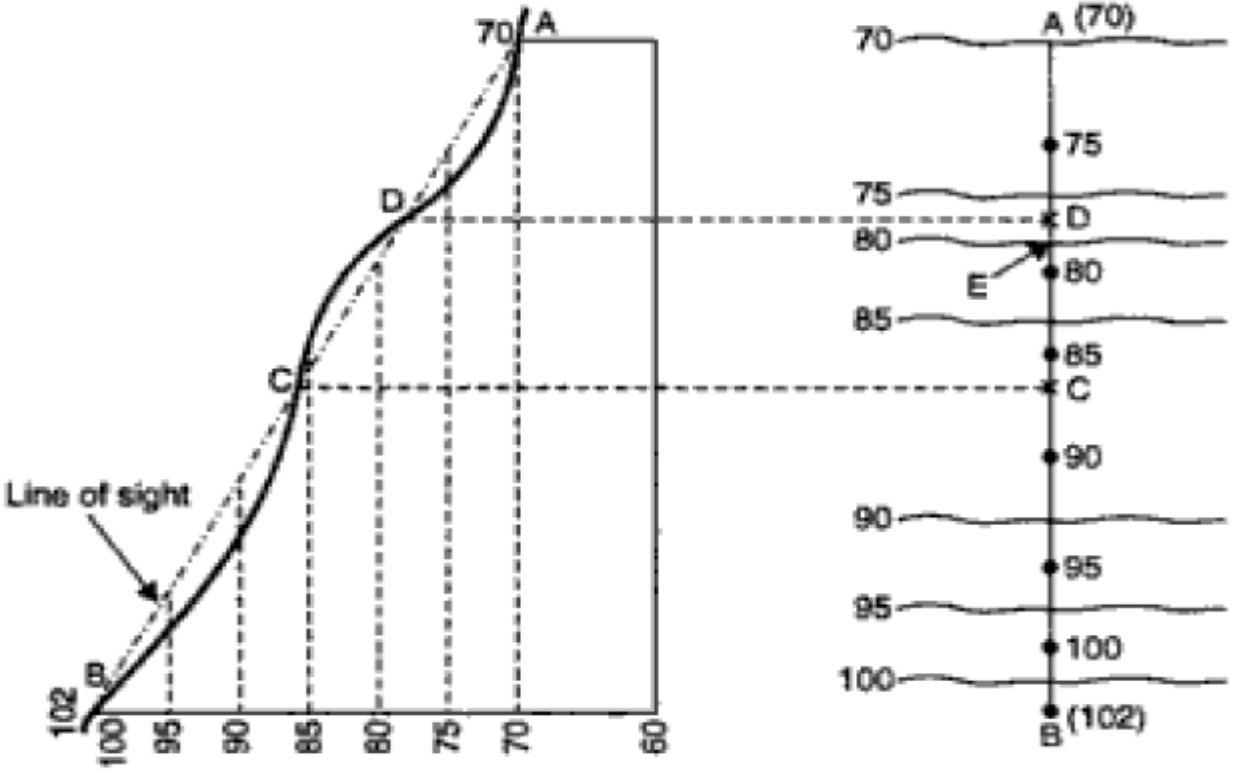
Application of contours

- Drawing of sections



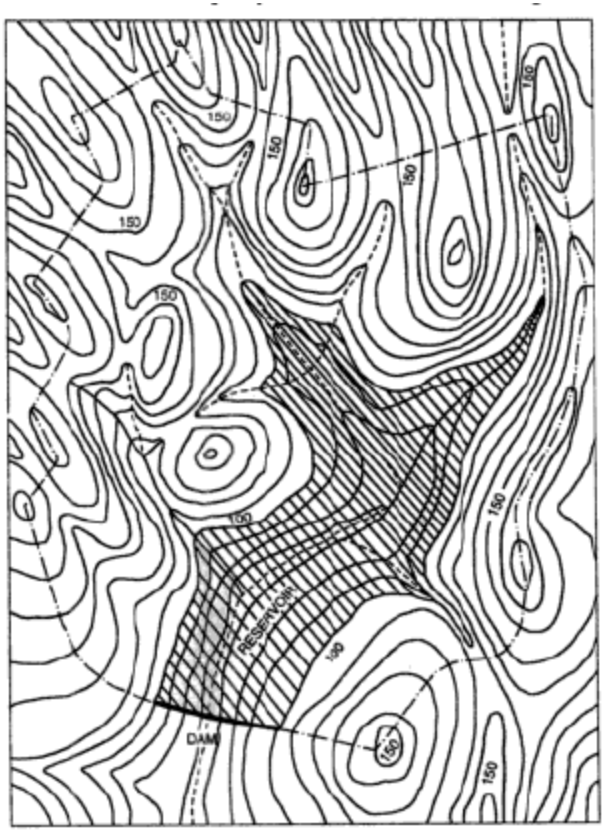
Application of contours…

- Determination of inter-visibility between points



Application of contours….

- Tracing of contour gradient and location of route
- Selection of suitable site
- Measurement of catchment area
- Calculation of reservoir capacity



Calculation of reservoir capacity

- The volume of water (for example between 100 m and 90 m contour) = the average area of the two contours multiplied by the contour interval (10 m).

$$V = \Sigma \frac{h}{2}(A_1 + A_2) \text{ by trapezoidal formula}$$

$$V = \Sigma \frac{h}{3}(A_1 + 4A_2 + A_3) \text{ by primoidal formula}$$

- The area enclosed in contours may be measured by a planimeter.
- Example…..