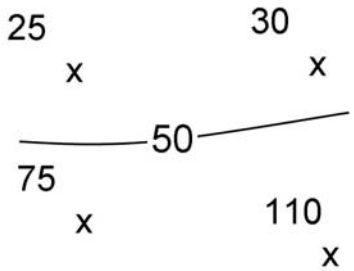
Isolines and contours: A general introduction

Background: Data which exhibit spatial patterns may be portrayed using isolines (e.g. the weather maps which show lines of equal pressure. An isoline is a line that joins points of equal value. Isotherms are lines of equal temperature, isobars are lines of equal pressure, isohyets are lines of equal precipitation, and contours are lines of equal elevation.

Every point on a given contour line is of the exact same value (e.g. the same pressure on a weather map). Contour lines always separate points of higher values from points of lower values. Contour lines never cross one other and they never split.

Construction of isolines: a series of steps should be followed to construct an isoline map:

1. The point data must first be located on a map (e.g. using a station model).
2. The isolines are then added to the map. In order to do this a series of decisions must be made. The first of which relates to the choice of interval at which the isolines are to be drawn. This may be decided by convention e.g. isobars (lines of equal pressure on weather maps) are drawn at 4 mb intervals. Alternatively, judgment is used to select an interval that allows trends to be shown clearly but prevent the map from becoming too cluttered.
3. Next the isolines must be drawn on or between the known data points. Locating the exact positions of the isolines is an example of the process of interpolation. In some cases the spacing can be determined precisely. For example, if an isohyet (lines of equal precipitation) spacing of 50 mm is being used, the 50 mm isohyet would pass mid way between two points with precipitation 25 and 75 mm, yet much closer to a point 30 mm than one 110 mm. The positioning between these latter two points can be determined precisely. If a second reference line is drawn between the 30 mm and 110 mm data points, the isohyet would lie 1/4 of the distance along the line from the 30 mm point and 3/4 of the distance from the 110 mm point. See diagram below.



When constructing isoline maps make sure all isolines are clearly labeled.

Information specific to weather maps

Weather maps are graphical displays of past, current or future meteorological conditions. Data from individual stations or model grid points are spatially extrapolated to give 'the big picture', an image which shows the synoptic scale conditions. That is the placement of cyclones and anticyclones, fronts and other features that are the active weather makers of the mid-latitudes. Most commonly we plot isobars (lines of equal pressure) and fronts (boundaries between different air masses) on weather maps.

Construction of isobars: Once data have been plotted, isobars and fronts are added to the weather charts. Isobars are lines connecting points of equal pressure. By convention these are drawn at intervals of 4 millibars (mb), with 1000 mb as a base reference (i.e. 996, 1000, 1004 mb). The isobars rarely pass through individual points, but rather between many of them, with the exact values being interpolated from data given on the chart. Note: The isobars should be smooth contours. Isobars reveal the horizontal distribution of pressure. As with other types of isolines, the relative closeness of isobars indicate the horizontal rate of pressure change or gradient. The closer the isobars are together the steeper the pressure gradient.

Identification of the location of fronts: A **front** is the boundary which separates two contrasting air masses. Because a front is a boundary between two differing 'atmospheric environments', the location of a front can be determined by looking for places of abrupt changes in conditions. Because several elements change across a front all are examined so that a frontal position might be located most accurately. For example:

1. Marked temperature contrast over a short distance
2. Wind arrows veering by as much as 90°
3. Cloud and precipitation patterns

The symbols used for warm, cold and occluded fronts are shown in Figure 6.10 of your text.

- A **cold front** is the leading edge of an advancing cold air mass (symbols on the front point into the warm air), which usually moves east/southeast across the N. American continent.
- A **warm front** is the leading edge of a retreating cold air mass (symbols on the front point into the cold air), which usually moves northward across the N. American continent.
- An **occlusion** is a front that develops when a cold front overtakes a warm front so that warm air is forced or pinched aloft.

Movement of fronts is very important for weather forecasting. For example, when a cold front passes over a given location it is probable that the location will experience colder temperatures, a change in wind direction, and often increasing cloud and potentially precipitation.

More information can be found at:
http://www.srh.weather.gov/srh/jetstream/synoptic/ll_analyze.htm
http://www.ametsoc.org/amsedu/online/info/samplecourse/b_act_print.pdf