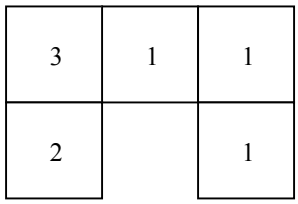
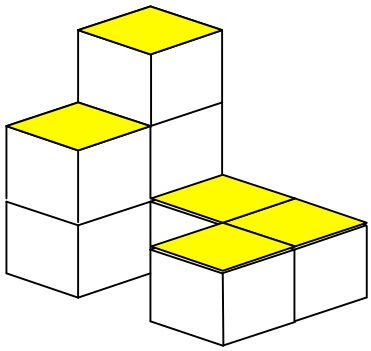
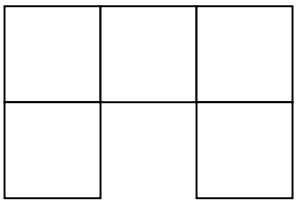
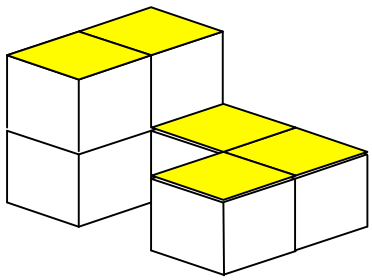
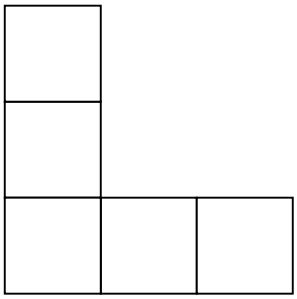
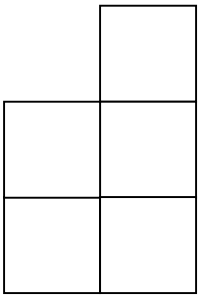
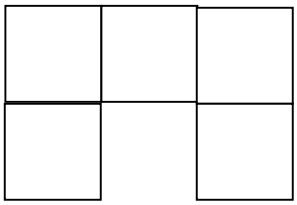
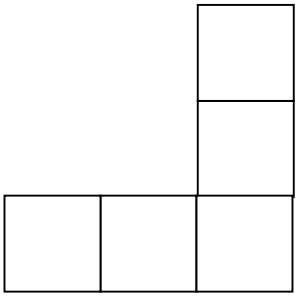
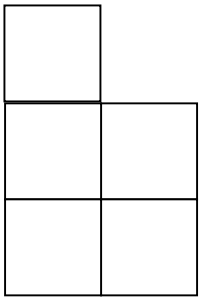
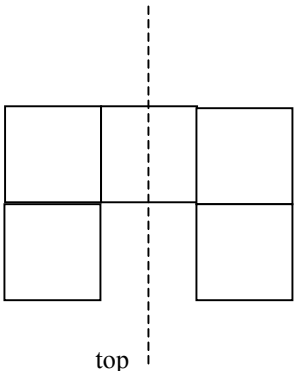
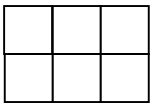
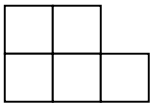
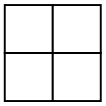
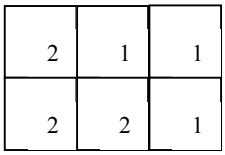
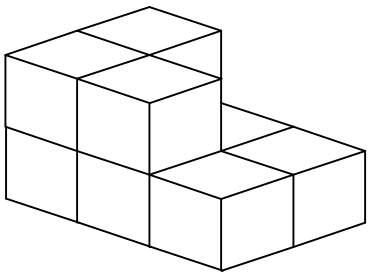
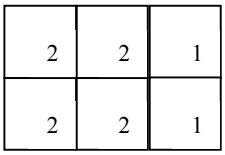
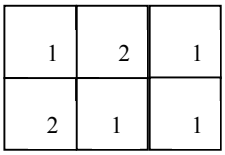
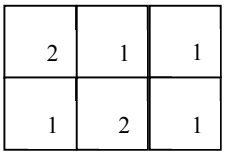
Ruins of Montarek: Concept with Explanation

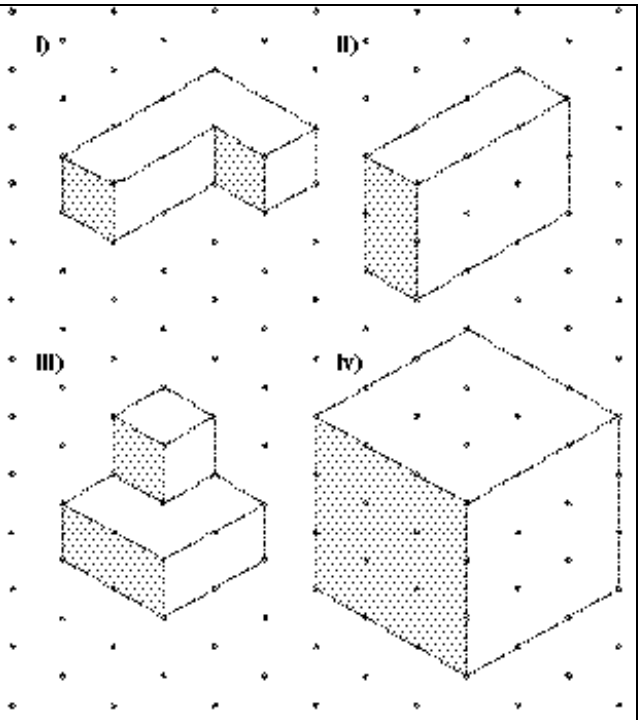
Concept	Example
Base Plan a plan that shows 2 pieces of information: the "footprint" of a building and the height of each column built on that base. With this information only one building is possible.	1.  With this plan we know that we have to arrange 8 cubes as shown in the perspective drawing below. 
Base Outline the "footprint" of a building without the additional information about the heights of the columns. An infinite number of buildings can be built on the same base outline.	2. The base outline shown below  is compatible with the building pictured in example 1, as well as the building pictured here: 

Orthogonal View a view of a face of a building from the point of view of someone whose line of vision is perpendicular to the face. Because the line of vision is perpendicular to the face of the building only one face can be seen at a time. A person can see the front, OR the right side, OR the left side, OR the base etc. Three orthogonal views are given as clues to the final building.	3. Below are the front, right and base views of the building shown in example 1.  front  right  base
Mirror Image is a copy of a shape that looks like a reflection in a mirror. We can say that one shape is the mirror image of another shape, or that one half of a shape is the mirror image of the other half.	4. For any building reduced to orthogonal views, the front view is the mirror image of the back view, the right side view is the mirror image of the left side view, and the top view is the mirror image of the base view. For the building in example 1 the views are:  back

	 left  top 5. Notice that if you drew a vertical line through the middle of the top view then one half would be identical to the other half, but reversed. We can say that one half of the top view is the mirror image of the other half.
Line Symmetry is a property of any shape where one half of the shape is the mirror image of the other half.	6. The top view shown in example 4 above has line symmetry, and the line of symmetry has been drawn to show how this divides the shape into two halves that are mirror images. Note: This idea of a line of symmetry is introduced in *Shapes and Designs*, and investigated rigorously in *Kaleidoscopes and Hubcaps*. A shape might have n line of symmetry, such as a scalene triangle, or one line of symmetry, such as an isosceles triangle, or a 2 lines of symmetry, such as a non-square rectangle, or 3 lines of symmetry,

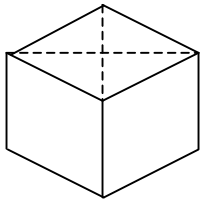
	such as an equilateral triangle, or 4 lines of symmetry, such as a square, or even more lines of symmetry.
Maximal- minimal, in this unit, refer to the buildings that use the most or least number of cubes. In some situations only ONE building can be drawn to match certain constraints. In that case we would say that this is a **unique** building. Note: students meet the idea of maximum and minimum again in *Covering and Surrounding*, where they find the maximum rectangular area enclosed by a fixed perimeter, and in *Filling and Wrapping*, where they investigate maximum volume, and in *Frogs and Fleas and Painted Cubes*, where they investigate the maximum or minimum of quadratic relationships. They also meet the idea of a unique shape in *Kaleidoscopes and Hubcaps and Mirrors*, where they investigate how much information would be necessary to define a unique triangle or a unique quadrilateral.	7. Suppose that the following orthogonal views are clues to a building.  base  front  right Then the base plan could be as shown.  And the building would be: 

	But exactly the same orthogonal views could lead to a different building. The following base plans are compatible with the same orthogonal views.  And  And  The minimum number of blocks used would be 8, and the maximum would be 10. There is only one maximal building, but as you can see above there is more than one arrangement of the minimum number of blocks.
Isometric drawing is a drawing where equal edges on the real-life model are represented by equal lengths on the drawing. Isometric dot paper facilitates such drawings.	8. The following are isometric drawings. The first could be made with 4 cubes. Notice that you can not see every edge of every cube, unless the cubes were transparent.



9.

The following is an isometric drawing of a single cube, from a top-right-front viewpoint; it is called this because you can see the top and right and front faces. All faces look like parallelograms, though we know they are really squares. Notice that a diagonal of any face is longer than an edge in reality, but the isometric drawing represents one diagonal as the same length as a side. In reality the diagonals are equal to each other, but in the isometric drawing one of the diagonals is represented as a longer segment. We have learned to interpret this as 3-D representation.



	10. Sometimes a perspective drawing or an isometric drawing can not show a part of every cube in a building. For example, if you make the building that goes with the following base plan you will find that the cube designated in color is hidden when the building is viewed from a front-top-right-perspective.