NAME:_____

DUE: Friday, Oct. 1st at the beginning of class.

INTRODUCTION

The purpose of this set of exercises is to help us assess the impact that a course like ME99 has on thinking skills. A similar set of exercises will be given to you at the end of the quarter. Your work will not be graded!

- Some of these activities will probably be too hard for you to do. Don't worry if some of them seem difficult.
- Take your time in working these problems.
- You are free to sketch on these pages and on the diagrams in order to work out these problems. Please do all of your sketching on the same page as the problem on which you are working.

Part 1 (Experience Retention)

1. (a) Sketch a side view of a bicycle FROM MEMORY.
(b) Label the parts (if you know the names).
(c) Sketch a rear or front view of a bicycle FROM MEMORY.

2. Describe as many designs of ice cream scoops that you have seen and/or used.

3. Consider the salad spinner demonstrated in class.

- What is the purpose of the device?
- What physical principle is being used?
- What do you think the main mechanism(s) of this device are?
- Does the salad bowl spin faster, slower or at the same rate as the handle?
- How many parts do you estimate are in the design?
- Create a sketch to describe how it works.

4. How does the faucet in your bathroom work? Do not go and take one apart, just think about how it *might* work inside.

Part 2 (Understanding of Existing Designs)

1. If you pull of the cable of the block and tackle shown below with a force of 60 pounds, what weight object can you lift?

2. A clutch is a mechanism that permits smooth, gradual connection and disconnection of two members having a common axis of rotation. Below is shown an *overriding clutch*. Explain how it works.

3. Consider the three designs of drills shown below. List at least one advantage and one disadvantage of each design.

Part 3 (Flexibility of Thinking)

You want to be able to control the flow of air or combustion gases up a chimney. Draw sketches of at least two possible solutions to this problem.

Part 4 (Spatial Reasoning)

NOTE: Small differences in the diagrams shown in this part should be ignored. For example, length of edges that appear to be roughly the same should be treated as if they are the same.

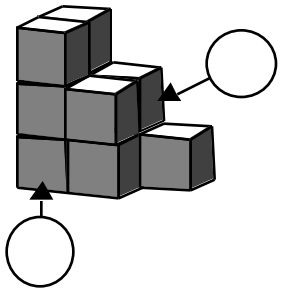
3D Pictorial View	Any view that clearly shows the 3D dimensional nature of an object
Orthographic View	The top, front, and side views of an object

Section 1

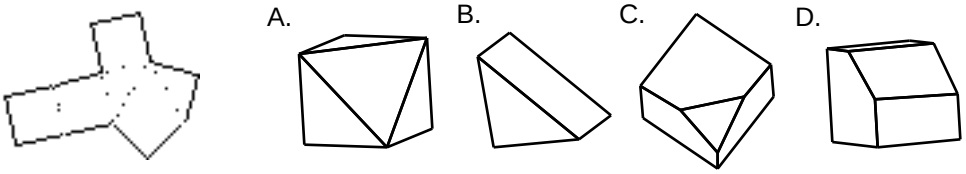
1. For each marked cube shown below, write in the circle how many cubes **touch** it.

Assume that:

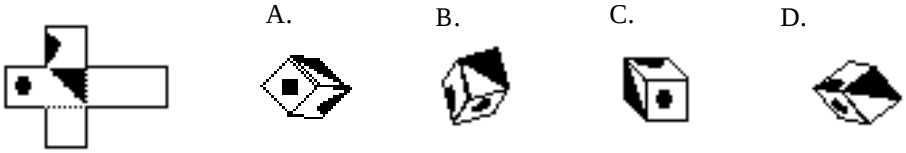
- all cubes are the same size and shape
- there are only enough hidden cubes to support the visible cubes
- cubes **touch** if any parts touch, *even an edge or a corner*



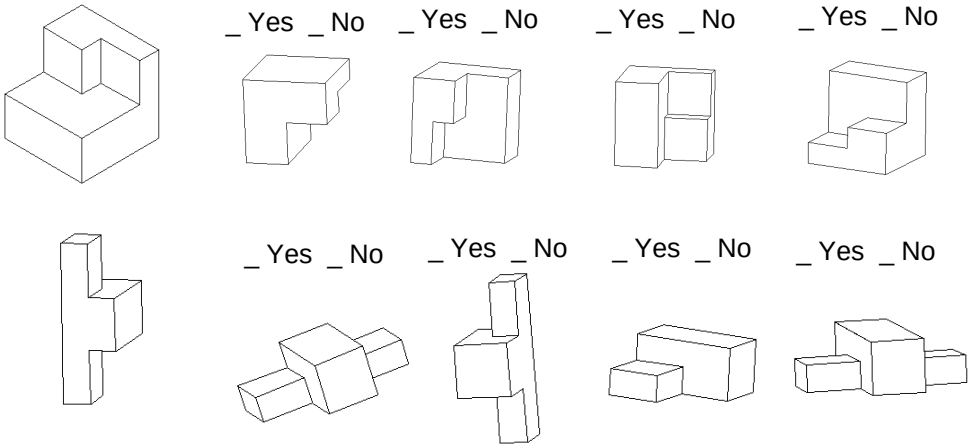
2. Choose the object on the right that would be made by folding the cardboard object on the dotted lines (as shown on left).



3. Choose the object on the right that would be made by folding the cardboard object depicted on the left on the dotted lines.



4. For each figure on the right, indicate whether or not it could represent the same object as shown on the left (none, some, or all of these figures may be correct).

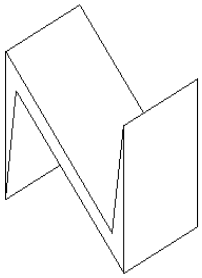


Section 2

Introduction

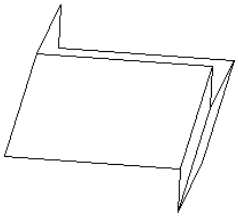
For each of the views on the right, indicate if it could be a view of the object on the left (i.e., it could be the same object). None, some, or all of these views may be consistent.

Example:

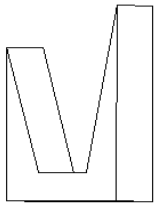


Mark which of the views below could be a possible view of the example.

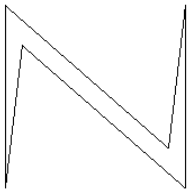
_ Yes _ No



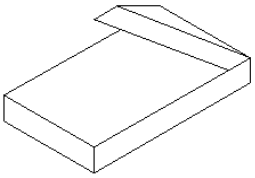
_ Yes _ No



_ Yes _ No

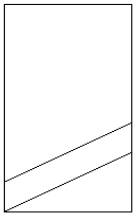


Object 1:

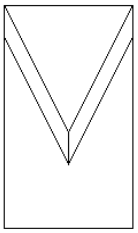


Mark which of the views below could be a possible view of object 1.

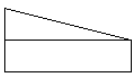
_ Yes _ No



_ Yes _ No



_ Yes _ No



Section 3

Introduction

You are given the front and side views of a stack of cubic blocks which are all the same size. Assume that blocks on the second and third layer are supported by blocks directly beneath them. The color of a block indicates which level it is on: black is the third level, dark gray the second, and light gray the first. Draw a top view of these blocks which includes **as many blocks as possible** to make it consistent with the front and side views. Use numbers to indicate height as shown.

Example:

Top View:

Side View:

Example 3D Pictorial View

Front View:

Task 1:

Top View:

Side View:

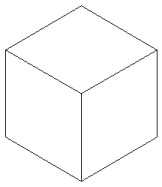
Front View:

Section 4

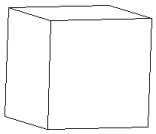
Introduction

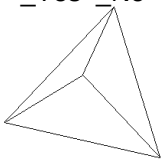
You are given a 3D pictorial view of an object. For each of the objects on the right, indicate whether or not it could fit with the first object in order to form a rectangular block. None, some or all of these choices may work.

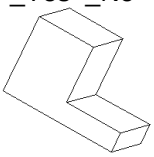
Example:

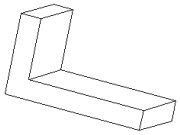


Indicate which objects below can possibly be combined with the example to form a rectangular block.

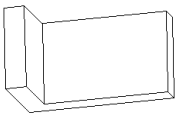
_Yes _No 

_Yes _No 

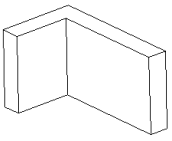
_Yes _No 

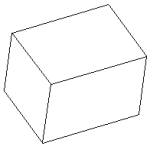
_Yes _No 

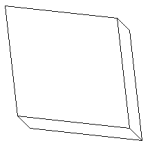
Object 1:

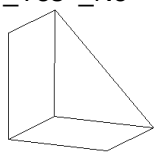


Indicate which objects below can possibly be combined with object 1 to form a rectangular block.

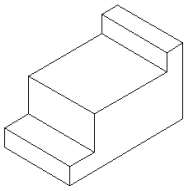
_Yes _No 

_Yes _No 

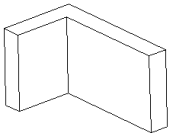
_Yes _No 

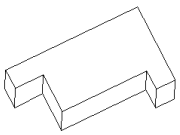
_Yes _No 

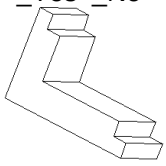
Object 2:

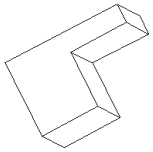


Indicate which objects below can possibly be combined with object 2 to form a rectangular block.

_Yes _No 

_Yes _No 

_Yes _No 

_Yes _No 

5. Consider the mechanism of a lawn sprinkler shown below. List the parts that rotate 360º. Which parts rotate less than 360º? pg. 51 of maculae, pg. 22 Parker.

8. Sketch a picture of the egg beater shown in class. Do the beaters move faster, slower, or at the same rate as the handle? Do the beaters rotate in the same or different directions? What is your estimate of the number of parts in the design?