

NAME: _____

INTRODUCTION

The purpose of this set of exercises is to help us assess the impact that a course like ME99 has on thinking skills. These examples are amazing like those given to you at the beginning 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 an external and interval view of a hand drill FROM MEMORY.
 - (b) Label the parts (if you know the names).
 - (c) Sketch a rear or front view of a hand drill FROM MEMORY

2. Describe as many designs of popcorn poppers that you have seen and/or used.

3. Consider the lawn sprinkler demonstrated in class (and shown below).
- What is the purpose of this device?
 - What source of power is used in driving this device?
 - What do you think the main mechanisms of this device are?
 - How many parts do you estimate are in the design?

Part 2 (Understanding of Existing Designs)

Consider the chain hoist shown below:

1. (1) If a force is applied at point A, pulling the chain in the direction shown:
 - (a) which direction will the load travel?
 - (b) how will the distance traveled by the load compare to the distance traveled by the point?
- (2) If a force is applied at point B, pulling the chain in the direction shown:
 - (a) which direction will the load travel?
 - (b) how will the distance traveled by the load compare to the distance traveled by the point?
- (3) If no force is applied to the chain, which direction will the load travel?

2. A brake is a mechanism that produces a force, greater than the driving force, to reduce the motion of an object or system. Below is a drawing of a drum brake, a type of brake commonly used in automobiles. Explain how the drum brake works.

3. Consider the popcorn poppers you described in question 2 of Part 1. List at least one advantage and one disadvantage of each design.

Part 3 (Flexibility of Thinking)

You want to be able to raise and lower a box within a shaft (an elevator). 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.

The following terminology is used in these activities:

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

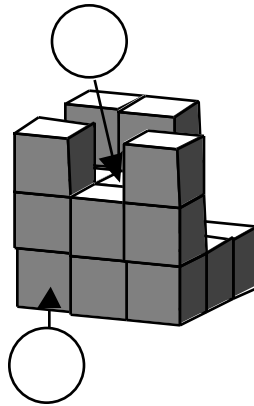
Section 1

Cube Counting:

Assume that:

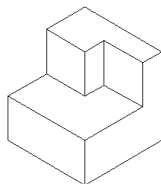
- all cubes are the same size and shape
- there are only enough hidden cubes to support the visible cubes
- cubes **touch** if any parts touch, *even an edge or a corner*

For each marked cube on the right, determine how many cubes touch it.

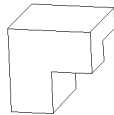


Solid Figure Turning:

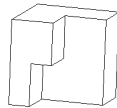
For each figure on the right, indicate whether or not it could represent the same object as shown on the left (none, some, or all of these figures may be correct).



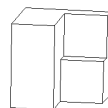
Yes No



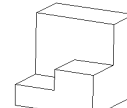
Yes No



Yes No



Yes No

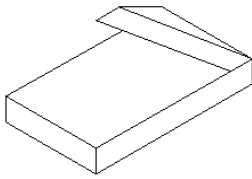


Section 2

Introduction

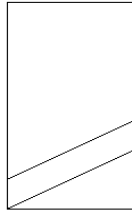
For each of the views on the right, indicate if it could be a view of the object on the left (i.e., it could be the same object). None, some, or all of these views may be consistent. Note: Two objects could be consistent with the original object even if they are not consistent with each other.

Example:

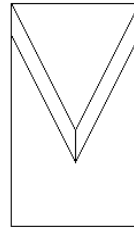


Mark which of the views below could be a possible view of the example.

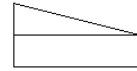
Yes No



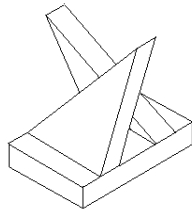
Yes No



Yes No

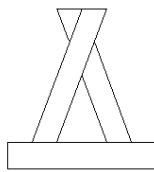


Object 1:

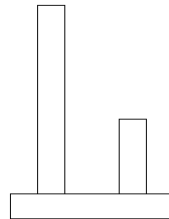


Mark which of the views below could be a consistent view of object 1.

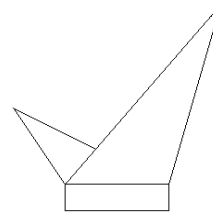
Yes No



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.

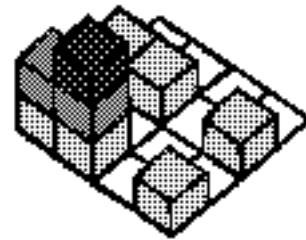
Example:

Top
View:

Front
View:

Side
View:

Example 3D Pictorial View



Task 1:

Top
View:

Front
View:

Side
View:

Task 2:

Top
View:



Front
View:



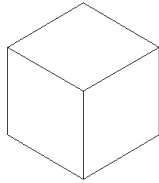
Side View:

Section 4

Introduction

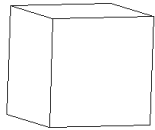
You are given a 3D pictorial view of an object. For each of the objects on the right, indicate whether or not it could fit with the first object in order to form a rectangular block. None, some or all of these choices may work.

Example:

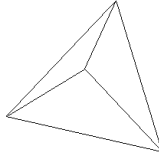


Indicate which objects below can possibly be combined with the example to form a rectangular block.

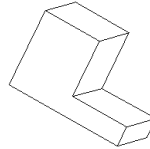
_Yes _No



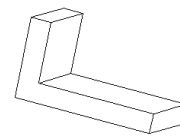
_Yes _No



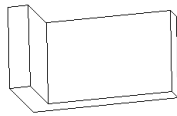
_Yes _No



_Yes _No

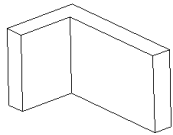


Object 1:

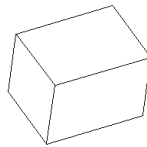


Indicate which objects below can possibly be combined with object 1 to form a rectangular block.

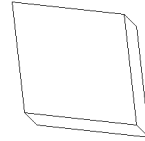
_Yes _No



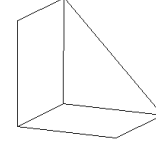
_Yes _No



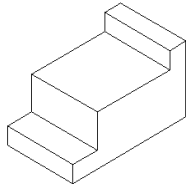
_Yes _No



_Yes _No

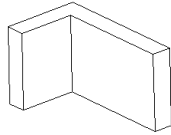


Object 2:

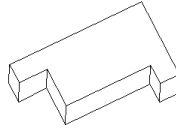


Indicate which objects below can possibly be combined with object 2 to form a rectangular block.

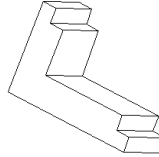
_Yes _No



_Yes _No



_Yes _No



_Yes _No

