There are 17 problems on this exam. Only those problems that say “explain” require explanations. Answers that require explanations will be given at most half credit without the required explanation. Be sure to follow all directions.

In problems 1-2 use the three set Venn diagram with sections numbered 1-8 to determine the specified information.

1. Use sets A, B, and/or C together with the operations of union, intersection, set difference, and/or complements to identify the set that includes the specified sections. (3 points each)
   
   (a) Sections 4, 7, and 8  
   (b) Sections 1 and 2

2. Identify by number the section(s) included in each of the following sets. (3 points each)
   
   (a) \((A \cup B) \cap (B \cup C)\)  
   (b) \(\overline{B} \cup C\)
3. The thirty students in Mrs. Smith’s third grade class were asked whether or not they like each of the fruits: Apples, Bananas, Cherries. Use the following clues to determine how many students fit in each section of the three set Venn diagram below where set A is for students liking Apples, B is for those liking Bananas, and C is for those liking Cherries. (8 points)

Eighteen students indicated that they like Cherries.
Six students indicated that they like both Bananas and Cherries.
Four students said they like all three fruits.
Two students said they like none of the fruits.
Four students indicated that they only liked the Apples.
None of the students liked just Apples and Cherries.
Nineteen indicated that they did NOT like Apples.

4. Use the completed Venn diagram in problem 3 to determine the following. (3 points each)

(a) \( n(A \cup B) \)

(b) \( n(A - C) \)

(c) The number of students who did not like Cherries
In problems 5-9 indicate what operation is needed to solve the problem and indicate by name the model that should be used to solve the problem. DO NOT SOLVE THE PROBLEMS. (4 points each)

5. In preparation for their annual Halloween party, the Munsters are getting ready to send out invitations. If they want to invite fifteen guests and the invitations come in packages of five, how many packages of invitations must Lily purchase?

6. Herman is nine feet tall and Eddie is four feet tall. In the next few years how much will Eddie have to grow in height in order to be as tall as his Dad?

7. Marilyn is responsible for preparing the punch for the party. If a guest drinks two cups of punch and she prepares twenty cups of punch, how many guests can receive punch?

8. Lily Munster is making the sandwiches for the party. She can put one of chicken salad, ham salad, or egg salad on rye, whole wheat, pumpernickel, or white bread. How many different sandwiches can she make?

9. Marilyn is baking bat-shaped cookies for the Halloween party. If she bakes two pans of cookies and each pan holds six cookies, how many cookies did she bake?
In problems 10-14 use an appropriate model to solve the problem. Explain your model in the context of the problem and be sure to answer the question(s) posed by the problem. (8 points each)

10. Herman is nine feet tall and Lily is five feet tall. How much taller is Herman than Lily?

11. Before the party starts Grandpa sneaks around and eats two of the eight cookies on the bat-shaped serving tray. How many cookies are left on the bat-shaped tray?
12. Herman is preparing candy buckets for the six children that will be at the party. If he has twenty pieces of candy and puts the same amount in each bucket, how many pieces of candy will each child receive?

13. Grandpa, who can turn himself into a bat, flies around the neighborhood each day. If he flies two miles each day how many miles will he fly in a week?
14. The Munsters are using neon paint to paint the pumpkins for their decorations. They have neon orange, neon yellow, neon blue, and neon pink paint available to paint the surface of each pumpkin and black or red paint available to paint the faces on the pumpkins. How many different decorated pumpkins can they make?

15. Start at 143 and count by twos in Base Six. Record your counting in the boxes below. (5 pts)
16. What number is represented by the Base Six blocks shown below? Show any necessary trades. (5 points)

![Base Six blocks diagram]

17. What property is illustrated in each of the following diagrams? Spell correctly and be specific. Diagrams are not drawn to scale. (3 points each)

(a) 

![Diagram A and B with clockwise rotation]

(b) 

![Diagram A and B]

If we rotate diagram A clockwise we can see that it matches diagram B.