<table>
<thead>
<tr>
<th>Problem</th>
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<tbody>
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<td>1–20</td>
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<tr>
<td>Total</td>
<td>84</td>
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Show all work.
Circle the correct answer. Each problem is worth 3 points.

1. The number of subsets of the set $A = \{1, 2, 3, 4, 5\}$ is
   a) 16    b) 32    c) 15    d) 5

2. The number of subsets of the set $A = \{1, 2, 3, 4, 5\}$ which have 2 elements is
   a) 5    b) 15    c) 10    d) 6

3. The sentence $p \rightarrow q$ is equivalent to
   a) $q \rightarrow p$    b) $\sim q \rightarrow p$    c) $\sim p \rightarrow \sim q$    d) $\sim q \rightarrow \sim p$

4. If $A = \{1, 2, 3, 4, 5\}$ and $B = \{1, 2, 3, 6\}$ then $A \cup B$ is
   a) $\{1, 2, 3, 4, 5, 6\}$    b) $\{1, 2, 3, 4, 5\}$    c) $\{1, 2, 36\}$    d) $\{1, 2\}$

5. If $A = \{1, 2, 3, 4, 5\}$ and $B = \{1, 2, 3, 6\}$ then $A' \cap B$ is
   a) $\{1, 2, 3, 4, 5, 6\}$    b) $\{1, 2, 3, 6\}$    c) $\{6\}$    d) $\{1, 2, 3\}$

6. If $n(A \cup B) = 12$, $n(A) = 5$, and $n(B) = 10$, then $n(A \cap B)$ is
   a) 17    b) 3    c) 0    d) 7

7. If $n(A \cap B') = 10$, $n(A) = 12$, and $n(B) = 12$, then $n(A \cup B)$ is
   a) 22    b) 10    c) 12    d) 20

8. In a room with 14 cows and 20 pigs, how many ways can you choose 4 cows and 3 pigs?
   a) $C_{20,4}C_{14,3}$    b) $C_{20,3}C_{14,4}$    c) $C_{20,3}C_{17,4}$    d) $C_{34,3}C_{31,4}$
9. $P_{10,2} =$
   a) 90  b) 100  c) 20  d) 45

10. $C_{8,6} =$
    a) 28  b) 48  c) 20,160  d) 40,320

11. $6! =$
    a) 6  b) 24  c) 120  d) 720

12. The number of possible 5 digit zip codes allowing repeated digits is
    a) 50  b) $P_{10,5}$  c) $C_{10,5}$  d) $10^5$

13. The number of possible 5 digit zip codes with only digits 1 and 3 is
    a) 10  b) 100  c) 32  d) 50

14. The number of possible 5 digit zip codes with exactly three 9’s and two 8’s is equal to
    a) 120  b) 20  c) 10  d) 90

15. The number of possible 5 digit zip codes with exactly four 9’s is equal to
    a) 10  b) 45  c) 125  d) 5

16. The number of different pizzas you can order if there are 3 different sizes and 4 different topping is
    a) 48  b) 12  c) 72  d) 7
17. If you flip a fair coin 3 times, what is the probability that you get two tails?
   a) 2/3       b) 3/8       c) 3/5       d) 1/2

18. If you flip a fair coin 4 times, what is the probability that you get two tails?
   a) 1/2       b) 2/5       c) 3/8       d) 7/16

19. If you roll a fair die what is the probability you don’t get a 4?
   a) 5/6       b) 4/5       c) 1/6       d) 3/4

20. How many different ways can you arrange the letters in KOOK into different words?
   a) 3       b) 6       c) 12       d) 16
Show any necessary work

21. Here \( \sim p \) is “not \( p \).”
(8 points, 4 each)
   a) Make a truth table for \( (\sim p \land \sim q) \rightarrow q \).

   b) Show \( \sim (q \land p) \) is equivalent to \( \sim p \lor \sim q \).

22. If \( n(A') = 20 \), \( n(U) = 50 \), \( n(B') = 10 \), \( n(A' \cap B) = 14 \), fill in a Venn Diagram and find
   a) \( n(A) \) and
   b) \( n(A \cup B) \).
(8 points)

23. In a classroom with 5 dogs, and 6 cats, and 20 chickens, how many ways are there to pick a president, a vice president, and a committe of 4 dogs, 2 cats, and 6 chickens?
(8 points)