Neatly print name: ________________________________

Student ID: ______________________

Date: ______________________

"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."

________________________________________
Signature of student

Academic Integrity Task Force, 2004

My signature in this blank allows my instructor to pass back my graded exam in class or allows me to pick up
my graded exam in class on the day the exams are returned. If I do not sign the blank or if I am absent from
class on the day the exams are returned, I know I must show my Texas A&M student ID during my instructor’s
office hours to pick up my exam.

________________________________________
Signature of student

Write all solutions in the space provided as full credit will not be given without complete, correct accompanying
work, even if the final answer is correct. Use techniques taught in class to solve; do not use brute force (do not
use “list by exhaustion” unless that is the only way to solve the problem). Fully simplify all your answers, and
give exact answers unless otherwise stated. Make sure that you indicate your answer clearly by circling your
response.

“There are only 10 types of people in the world — those who understand binary, and those who don't.”
(10 pts: 1 pt for each TF) On problems 1 through 10, circle either “True” or “False.”

1. True or False: The definition of addition of whole numbers is: Let $A$ and $B$ be finite sets. If $n(A) = a$ and $n(B) = b$, then $a + b = n(A \cup B)$.

2. True or False: Place value assigns a value of a digit depending upon its placement in a numeral.

3. True or False: The set $\{0, 2, 4\}$ is closed under addition.

4. True or False: The Egyptian numeration system had the additive property.

5. True or False: The numeral 100,039 is $CIXL$ in Roman numerals.

6. True or False: $\mathbb{N} \sim E$, where $\mathbb{N}$ are the natural numbers and $E$ are the even natural numbers.

7. True or False: If $C = \{h, *, \otimes, \mathbb{Z}\}$ then $C$ has 14 nonempty proper subsets.

8. True or False: $n(\emptyset) = 0$

9. True or False: For any sets $B$ and $C$, $B \times \emptyset \times C = 0$.

10. True or False: The inverse of the statement, “If today is Monday, I will dance” is “If today is not Monday, I will not dance.”

11. Indicate, by name, in which step of Poyla’s Four-Step Problem Solving Process each of the following belong.

   a. (2 pts) Keep an accurate record of your work: ___________________________

   b. (2 pts) Look for a pattern: ___________________________

   c. (2 pts) Solve the equation: ___________________________

12. (7 pts) Use Gauss’s method to find the sum: $23 + 29 + 35 + \ldots + 143$. 

13. (2 pts) Provide a diagram counterexample to the statement, “All rectangles are squares.”

14. (8 pts) Name the four whole number addition properties and give one example of each.

15. (5 pts) Negate the statement, “There is at least one rose that is blue and every penny is made of copper.”

16. (5 pts) Complete the following truth table.

\[
\begin{array}{ccccccc}
 p & q & \sim q & p \rightarrow q & q \lor (p \rightarrow \sim q) \\
\end{array}
\]

5-point Bonus: \( q \lor (p \rightarrow \sim q) \) is an example of a ______________________. I am not looking for “statement,” “conjunction,” “disjunction,” “conditional,” “negation,” or “reasoning” as the answer.

17. (4 pts) Write the following Babylonian number in Hindu-Arabic: __________________________

18. (5 pts) Use the set take away model to illustrate 4 – 3.
19. (6 pts) If \( a_1 = 4 \), \( a_2 = 10 \), and \( a_n = 2a_{n-1} - a_{n-2} \) for natural number \( n > 2 \), give the next three terms of this sequence.

\[
\begin{align*}
a_3 &= \quad \\
a_4 &= \quad \\
a_5 &= \\
\end{align*}
\]

20. (4 pts) \( 354_{\text{six}} - 453_{\text{six}} = \)

21. (4 pts) Convert \( 275_{\text{ten}} \) to base twelve.

22. (4 pts) Using colored rods, illustrate the commutative property of addition using 2 and 3 as the addends.

23. (4 pts) If \( A \subseteq B \), \( B \subseteq A \), and \( A = \{ x \mid x \in \mathbb{N} \text{ and } x \leq 4 \} \), use roster notation to write set \( B \).

\[
B = \quad \\
\]
24. (5 pts) Use the expanded algorithm to find the sum: 234 + 734 + 93.

25. (3 pts) What justifies $235 = 2 \cdot 10^2 + 3 \cdot 10^1 + 5 \cdot 10^0$? ________________

26. (5 pts) Find the sum, as well as model with Base-Two Blocks: $110_\text{two} + 11_\text{two}$.

27. (4 pts) Given $B = \{a, e\}$ and $C = \{h, m\}$. $C \times B =$ ________________

28. (5 pts) Using the “less than” set definition, prove that $1 < 2$.

29. (4 pts) Write the numeral 418 in Mayan.