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1. The prime factorization of 651 and 189 are

$651 = 3^1 \cdot 7^1 \cdot 31^1$

$189 = 3^3 \cdot 7^1$

$\gcd(651, 189) = 3^1 \cdot 7^1 \cdot 31^0$

$= 3 \cdot 7 \cdot 1$

$= 21$

$\text{lcm}(651, 189) = 3^3 \cdot 7^1 \cdot 31^1$

$= 5859$

(Answer)

2. "DO NOT PASS GO"

First replace the letters with numbers;

3-14 13-14-19 15-01-18-18 6-14

Replacing these numbers p by $f(p) = (p-9) \bmod 26$

20-5 4-5-10 6-17-9-9 23-5

The encrypted message:-

"UF EFK GRJJ XF"

4. $A = \{x | x \text{ is a prime number and } x \leq 5\}$

$= \{2, 3, 5\}$

$2^n = 2^3 = 8$

$P(A) = \{\emptyset, \{2\}, \{3\}, \{5\}, \{2,3\}, \{2,5\}, \{3,5\}, \{2,3,5\}\}$

Cardinality of power set of $A = 8$.

(Answer)

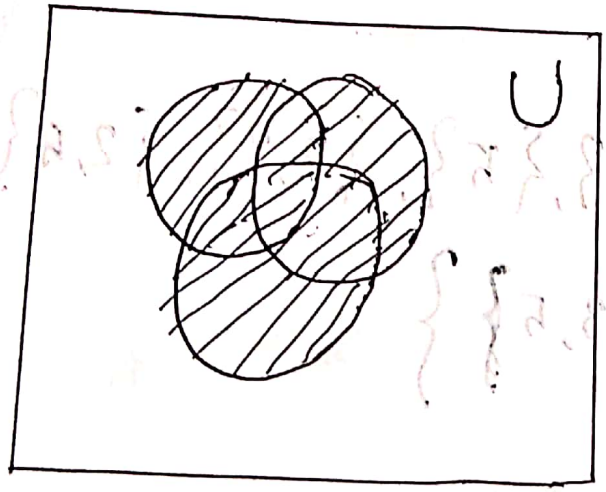
3. $A = \{0, 2, 4, 6, 8\}$

$B = \{0, 1, 2, 3, 4\}$

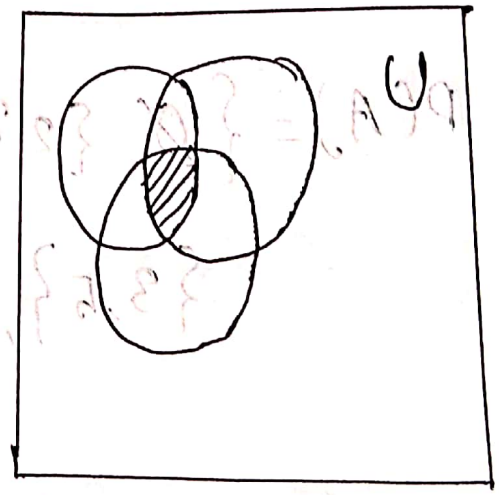
$C = \{0, 3, 6, 9\}$

$A \cup B \cup C = \{0, 1, 2, 3, 4, 6, 8, 9\}$

$A \cap B \cap C = \{0\}$



$A \cup B \cup C$



$A \cap B \cap C$

6. Truth table:-

p	q	r	q∨r	p∧(q∨r)	p∧q	p∧r	(p∧q)∨(p∧r)
T	T	T	T	T	T	T	T
T	T	F	T	T	T	F	T
T	F	T	T	T	F	T	T
T	F	F	F	F	F	F	F
F	T	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	F	T	T	F	F	F	F
F	F	F	F	F	F	F	F

So, p∧(q∨r) and (p∧q)∨(p∧r) are logically equivalent.