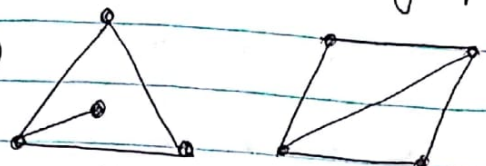
I. GRAPH THEORY

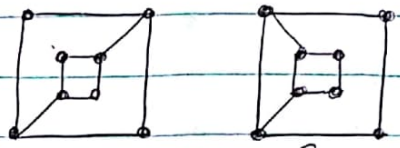
Q1 Are the following pairs of graphs isomorphic? Give reasons?

(i)



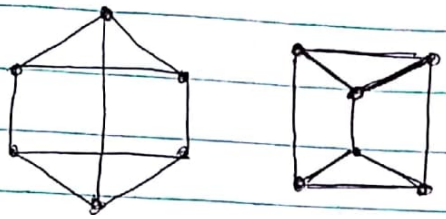
G_1 G_2

ii)



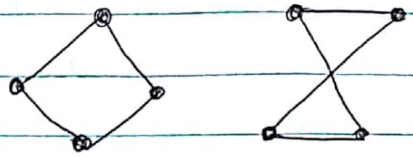
G_1 G_2

iii)



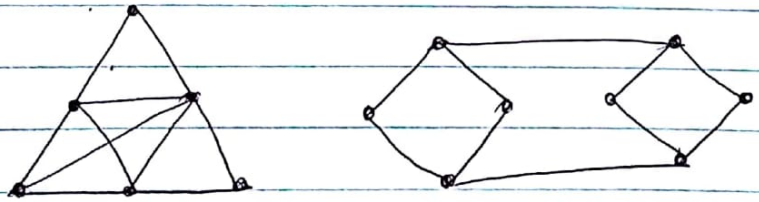
G_1 G_2

iv)



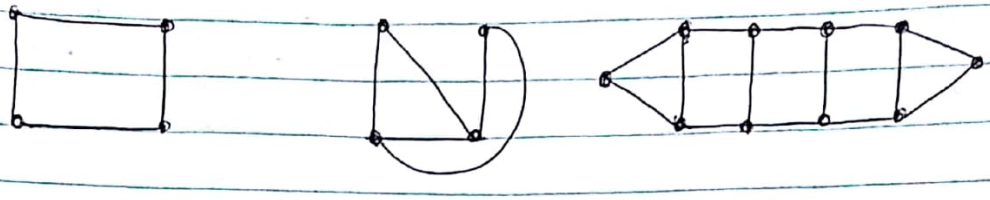
Q2 Which of the following graphs has an Eulerian path? Justify your answer.

Q3 Determine whether the graphs have a Hamiltonian circuit

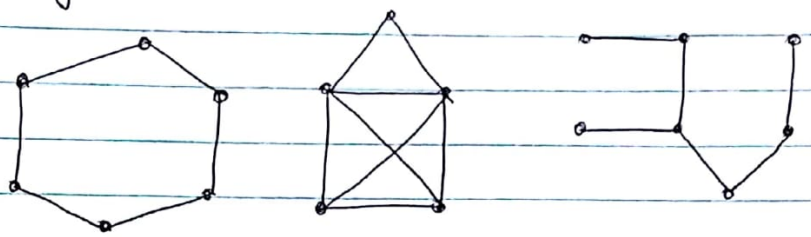


Q4. Is every Hamiltonian graph Eulerian? Justify.
Is every Eulerian graph Hamiltonian? Jusify.

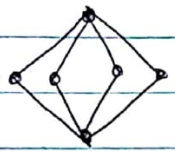
Q5 State Euler's formula for connected graphs. Verify Euler's formula for the following plane connected graphs.



Q6 Determine which of the following graphs are bipartite graphs. Find the partitions of the vertices if yes.



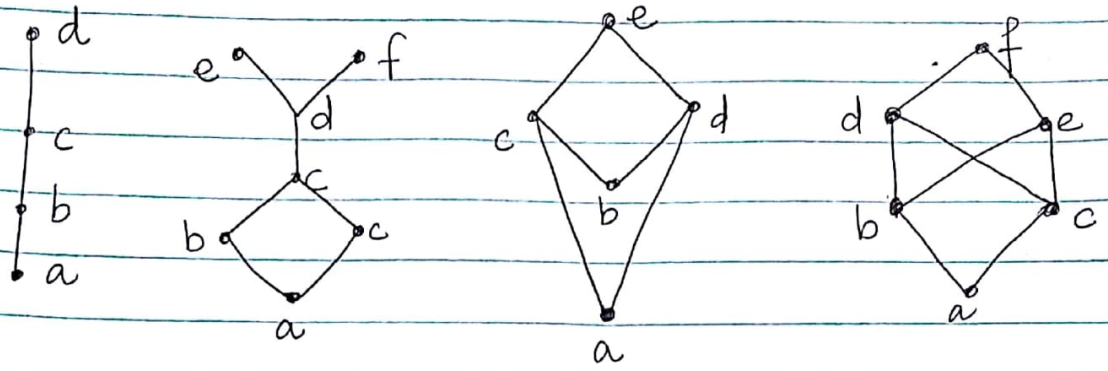
Q7 State Hand-Shaking lemma and verify the same for



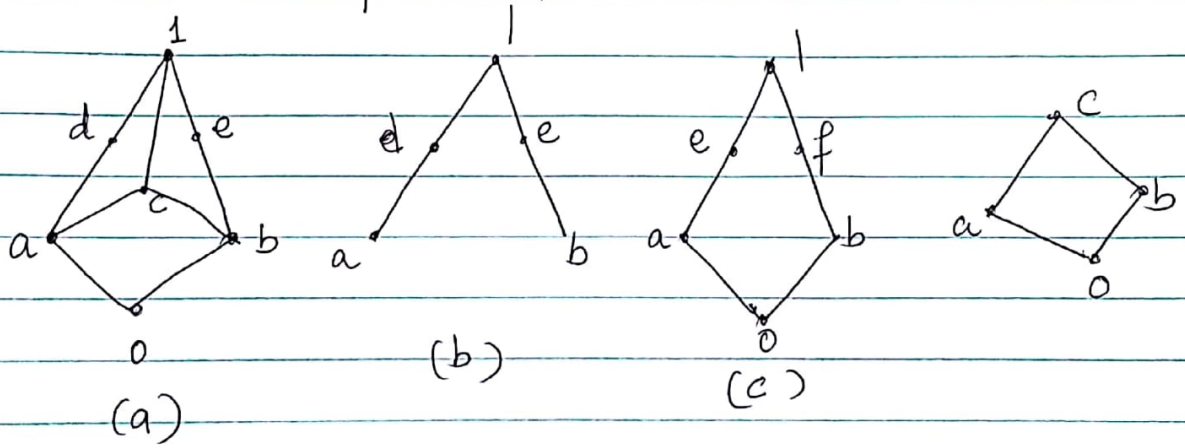
Q8 Draw three 3-regular graphs.
Draw $K_1, K_2, K_3, K_4, K_5, K_6$.

II LATTICE

Q1 Which of the Hasse Diagrams represent lattices?



Q2 Which of the figures (b), (c), (d) can be a sublattice of (a) ?



Q3 Find the complement of each element in D_{20} where D_n represents the set of all positive divisors of n under the relation of divisibility.

Q4 Prove or disprove that a sublattice of a bounded lattice is also bounded.

III. NUMBER THEORY

Q1. Evaluate (a) $5^{15} \bmod 13$ (b) $70^{-1} \pmod{101}$

Q2. (a) Show that $2222^{5555} + 5555^{2222}$ is divisible by 7.
(b) Show that $111^{333} + 333^{111}$ is divisibly by 7.

Q3. (a) Find the last digit of 7^{313}
(b) Find the last two digits of 13^{515}

Q4 Using Euclid's Algorithm, find x and y satisfying the following.
(a) $\gcd(24, 138) = 24x + 138y$
(b) $\gcd(1769, 2378) = 1769x + 2378y$.

Q5 a) Using Sieve of Eratosthenes find the primes upto 80.
b) Find prime factors of 100, 641, 100!, $\phi(360)$

Q6. Solve the simultaneous congruences

(a)
$x \equiv 1 \pmod 2$
$x \equiv 2 \pmod 3$
$x \equiv 3 \pmod 5$
$x \equiv 7 \pmod 7$

(b)
$x \equiv 4 \pmod 4$
$x \equiv 5 \pmod 5$
$x \equiv 8 \pmod 7$
$x \equiv 2 \pmod 9$

Q7. (a) Find the quadratic residues of 19, 23.

(b) Compute (i) $\left(\frac{27}{31}\right)$ (ii) $\left(\frac{-27}{31}\right)$