Assignment Set

Dated: 07/02/2019 & Submission deadline: 1.30 PM,14/02/2019.
Submit in my office within the deadline. You can slip under my office door. Submission after deadline will lead 50% deduction of marks obtained.

1. Prove the validity of the following sequents:
   (a) $p \to (q \vee r), \neg q, \neg r \vdash \neg p$
   (b) $p \vee \neg p \vdash \neg(r \to q) \wedge (r \to q)$
2. Let us suppose we want to prove the proposition P. Let P_1 and P_2 are two propositions at least one of which is true. Then establish a logical equivalence with the help of these propositions to outline the method of "proof by cases". **Hint. use $P_{1(2)} \to P$ is true**

   Prove the statement: There must be a prime between n and $n!$, where n is an integer greater than 2.
3. Prove: Let $x \in \mathbb{Z}$. If $x^2 - 6x + 5$ is even, then x is odd. Clearly state the method used for this proof.
4. Prove that set of rationals is countable.
5. *Product of two even numbers is even*

   Prove the above statement by contradiction.

   Prove the contrapositive of the above proposition.
6. *Every amount of postage that is at least 12 cents can be made from 4-cent and 5-cent stamps*

   Give a proof of the proposition. What kind of method have you used here?
7. Prove every subset of a countable set is countable
8. Let $A = [-1, 1]$, and let $f : A \to A$, $g : A \to A$, and $h : A \to A$ be functions defined by (i) $f(x) \sin x$, (ii) $g(x) = \sin \pi x$, and (iii) $h(x) = \sin \frac{\pi}{2} x$.

   Check whether these functions are one-one, onto or bijective.

   Let $B = [0, 1]$. Is set B is equivalent to A?