Assignment 2
HUL479
Algorithms in Ancient India

March 20, 2017

Instructions:

- Due date for submission: 31st March 2017.
- Attempt all questions from Either Part A Or Part B.
- Numbers to the right of each question indicate the marks.
- In case of Part B, a soft copy of the code along with the sample input and output should be submitted.

PART A

1. If the solution of the equation $ax + c = by$ is (α, β), prove the following. (20)
   (a) The solution of the equation $ax - c = by$ is $(b - \alpha, a - \beta)$
   (b) The solution of the equation $-ax + c = by$ is $(b - \alpha, \beta - a)$
   (c) The solution of $a.k.x + c.k = b.y$ is $(\alpha, k * \beta)$
   (d) The solution of $ax + ck = b.k.y$ is $(k.\alpha, \beta)$.
   (e) The solution of $ax \pm b.m + c = by$ is $(\alpha, \beta \pm m)$.
2. Solve the following equations.
   (a) $9x^2 + 52 = y^2$ (5)
   (b) $13x^2 - 13 = y^2$ (5)
   (c) $13x^2 + 13 = y^2$ (5)
   (d) Let N be the single digit sum of your admission identity number (ignoring the letters in it). If N is equal to 1,4, or 9, multiply it by 10. Solve $Nx^2 + 1 = y^2$. (10)

3. For the equation $Nx^2 + 1 = y^2$, show that $x = \frac{2a}{N-a^2}$ is a possible value. (5)

4. Give a general algorithm to solve an equation of type $ax + c = by$ by Kuṭṭaka method. (20)

5. Give a general algorithm to solve an equation of type $Px^2 + s = r^2$ by Chakravāla method. (30)

PART B

1. Write a programme to solve a linear Diophantine equation by Kuṭṭaka method. (40)
   Test your programme on the following examples.
   $60x + 3 = 13y$
   $100x + 90 = 63y$
   $17x + 1 = 15y$
   $60x + 18 = 25y$

2. Write a programme to solve a quadratic Diophantine equation by Chakravāla method. (60)
   Test your programme on the following examples.
   $11p^2 + 1 = r^2$.
   $11p^2 - 1 = r^2$.
   $67p^2 + 1 = r^2$.
   $61p^2 + 1 = r^2$.
   $4p^2 + 1 = r^2$.