Assignment 1
HUL479
Algorithms in Ancient India

January 25, 2017

Instructions:

- Due date for submission: 6^{th} February 2017.
- Attempt all questions from Part A OR any 3 from 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.
- In case of Part B, modularity, and documentation will carry 10 marks.

PART A

1. Write the krama pāṭha and Ganapāṭha for the following string of Gayatri mantra. (10)
   dhiyaḥ yaḥ na pracodayāt.
2. Give all possible De Bruijn sequences of length 4 of binary alphabet. (20)
3. Classify each akṣara in the following śloka into laghu and guru.
   pratyādiṣṭam samaraśirasaḥ kāndīśībhūyanaṣṭtaṁ (5)
4. Explain Kedar Bhatt's procedure for prastāra for generating all combinations of 4 aksharas, explaining at each step how it is arrived at from the previous one. (10)
5. Explain why Kedar Bhatt did not need any algorithm for Naṣṭa. (5)
6. List the positions of chandas with 1 laghu, 2 laghus, etc. in a prastāra of 5 syllables (10)

7. Explain the following shloka by Bhaskaracharya describing a formula to find the sum of all permutations of n digit number. (10)
sthānāntamekādicayāṅkaghātaḥ saṃkhyāvibhedā nitaiḥ syuraṅkaiḥ .
bhakto'ṅkamityāṅkasamāsanighnaḥ sthāneṣu yukto mitisaṃyutiḥ syāt .. 261 ..

ghāḥ The product	ekādi of 1, 2, 3, ...	cayāṅka sthānāntam upto last digit of given number N
syuḥ shall be	saṃkhyāvibhedāḥ number of permutations P	niyataiḥ aṅkaiḥ of given n digits.
saḥ ghāḥ The product	nighnaḥ multiplied by	aṅkasamāsa sum of digits s
bhakta aṅkamitya divided by number of digits n,	yuktāḥ (and) result S' being filled	
sthāneṣu in places of digits	syāt shall be	mitisaṃyutiḥ sum S of all permutations.

8. Explain the formula given by Baudhāyana for drawing a circle of area equal to a given square. Calculate the error in the area of a circle thus drawn. (10)

9. Following the procedure of squaring a rectangle, give a series for approximate value of square root of 3 upto 4 terms. (15)

10. Find the sum of all permutations of 3 digit numbers formed with 7, 8 and 9 using Bhaskarachary's formula and verify it with actual sum. (5)

PART B

1. Write a programme to generate the Ghanapāṭha of a mantra.
Test it with the following string of Gayatri Mantra.
dhiyaḥ yaḥ na pracodayāt.

2. Write a programme to generate all possible De Bruijn sequences of a given length of binary alphabet.

3. Write a programme to classify a given string of akṣaras into laghu guru.

4. Write a programme to generate the sequence of binary numbers of n bits recursively following Piṅgala's algorithm.

5. Write a programme implementing Piṅgala's algorithm for 2^n.