Mid Semester Supplementary Examination
HUL479
Algorithms in Ancient India

Date: 11.04.2017

Max marks: 100

Instructions:

- All questions are compulsory
- Numbers to the right of each question indicate the marks.

1. Write a note on 3 Prakṛti and 8 Vikṛti pāṭhas.
   Write down all the 11 pāṭhas for the input sequance `1234', where 1,2,3 and 4 are the four distinct padas. (10)

2. What is a De Bruijn sequence? Give an example of De Bruijn sequence for a binary alphabet of length 2. (10)

3. Classify each akṣara in the following śloka into laghu and guru.
   या सृष्टिः स्रष्टुराद्या वहति विधिहुतं या हविर्या च होत्री
   ये द्वे कालं विधत्तः श्रुतिविषयगुणा या स्थिता व्याप्य विश्वम्
   यामाहुः सर्वबीजप्रकृतिरिति यया प्राणिनः प्राणवन्तः
   प्रत्यक्षाभिः प्रसन्नस्तनुभिरवतु वस्ताभिरष्टाभिरीशः (10)

4. Explain Kedar Bhatt's procedure for prastāra for generating all combinations of 3 aksharas, explaining at each step how it is arrived at from the previous one. (8)

5. Explain Piṅgalaś sūtras
   द्विकौ ग्लौ 8.20
   मिश्रौ च 8.21
   पृथग्ला मिश्रः 8.22
   वसवस्त्रिकाः 8.23
   for generating sequences of binary numbers. Explain the recursion involved in the generation. (5+8)

6. List the positions of chandas with 1 laghu, 2 laghus, etc. in a prastāra of 5 syllables. (8)

7. Give the construction of a square of given length as described in the Śulbasutras. (5)

8. Explain the formula $\sqrt{2} = 1 + \frac{1}{3} + \frac{1}{3.4} - \frac{1}{3.4.34}$, geometrically following the procedure of conversion of a rectangle into a square. (10)

9. Explain why total number of meters with n mātrās is equal to the sum of total number of meters with $n-1$ mātrās and total number of meters with $n-2$ mātrās. (5)

10. For each of the following linear Diophantine equations either find all the solutions using Kuṭṭaka method or explain why there is no integral solution. (8)

$$12x - 50 = 18y$$

$$47x + 11 = 30y$$

11. Using Kuṭṭaka method, tell me, if it is possible to have 50 coins, a mix of 1 paisa, 10 paisa, and 25 paisa coinsa with a total of 2 Rs.? If yes, solve by Kuṭṭka method. (8)

12. If (α, β) is the solution of the kuṭṭaka $ax + 1 = by$, then prove that the solution of $ax + ck = b.k.y$ is $(k.\alpha, \beta)$. (5)