Assignment 3
FN204
Algorithms in Ancient India

April 15, 2018

Instructions:

- Due date for submission: 4^{th} May 2018.
- Numbers to the right of each question indicate the marks.

1. Show that $x = \frac{2a}{N-a^2}$ is a possible solution for the equation $Nx^2 + 1 = y^2$. (5)
2. Solve the equation $32x^2 + 1 = y^2$ by Cakravāla method. (8)
3. There are 8 books (A,B,C,D,E,F,G,H) that are interdisciplinary in nature. Various disciplines to which these books belong to are as shown below.
   - Discipline 1: D,E
   - Discipline 2: B,C,D,F,G,H,I
   - Discipline 3: A,B
   - Discipline 4: F,I
   - Discipline 5: C,D,E,F,G,H,I
   - Discipline 6: G,H

   (a) Is it possible to arrange these books in such a way that all the books belonging to a certain discipline are together?

   (b) If yes, in which order should they be arranged?
   If there are multiple ways of arranging them, indicate all of them.

   (10)

4. Below are given a set of sūtras from Pāṇini's Aṣṭādhyāyī, in their expanded form (by borrowing the words from the previous sūtras in order to make each sūtra self sufficient in itself). The borrowed words are shown in parenthesis. Show that if we follow the factorisation as in Mathematics, we arrive at the sūtras with words excluding those in parenthesis. (10)

   - 6-1-87 ād guṇaḥ (saṃhitāyām aci ekaḥ pūrvaparayoḥ)
   - 6-1-88 vṛddhiḥ eci (saṃhitāyām ekaḥ pūrvaparayoḥ ād)
   - 6-1-89 etyedhatyūṭhsu (saṃhitāyām ekaḥ pūrvaparayoḥ ād vṛddhiḥ eci)
   - 6-1-90 āṭaḥ ca (saṃhitāyām aci ekaḥ pūrvaparayoḥ vṛddhiḥ)
   - 6-1-91 upasargāt ṛti dhātau (saṃhitāyām ekaḥ pūrvaparayoḥ ād vṛddhiḥ)
   - 6-1-92 vā supi āpiśaleḥ (saṃhitāyām ekaḥ pūrvaparayoḥ ād vṛddhiḥ upasargāt ṛti dhātau)
   - 6-1-93 ā ot amśasoḥ (saṃhitāyām aci ekaḥ pūrvaparayoḥ)
   - 6-1-94 eṅi pararūpam (saṃhitāyām ekaḥ pūrvaparayoḥ ād upasargāt dhātau)

   Explain in what way anuvṛtti is different from the factorisation in Mathematics.

5. What is a pratyāhāra? How many pratyāhāras are possible with the following śivasūtras? (7)

   a i u (Ṇ)
   ṛ ḷ(K)
   e o (Ṇ)
   ai au (C)
   ha ya va ra (Ṭ)
   l (Ṇ)

   Is there any ambiguity in the pratyāhāras? If yes, which pratyāhāras are ambiguous?