CS201: MATHEMATICS FOR COMPUTER SCIENCE - I

NITIN SAXENA

ASSIGNMENT 2

POINTS: 35

DATE GIVEN: 18-AUG-2016 DUE: 26-AUG-2016(6PM)

Rules:

- You are strongly encouraged to work *independently*.
- Write the solutions on your own and honorably *acknowledge* the sources if any.
  `http://cse.iitk.ac.in/pages/AntiCheatingPolicy.html`
- Submit your solutions, before time, to your TAs as per the roll numbers: Amit Sinhababu (12000–150130), Pranav Bisht (150131–150365), Ashish Dwivedi (150366–150600), Pulkit Kariryaa (150601–150840).

Question 1: *[3 points]* Write a pseudocode to find the next natural number in base b.

Question 2: *[4 points]* Learn what a graph is. Then, show that the sum of degree of each vertex is twice the number of edges.

Question 3: *[3 points]* Find out the total number of r-ary functions from $[n]$ to $[k]$.

Question 4: *[7 points]* Show that the number of surjective (onto) maps from a set with n elements to a set with k elements is,

$$\sum_{i=0}^{k}(-1)^i\binom{k}{i}(k-i)^n\,.$$

Question 5: *[7 points]* Find all possible solutions for a sequence S_n which satisfies,

$$S_n = S_{n-1} + 6S_{n-2}\,.$$

Question 6: *[3+7+1 points]*

(1) Suppose α is a rational. Show that there exists an $n_0 \in \mathbb{N}$ such that for every rational number $\frac{p}{q}$ with $1 \leq q < n_0$,

$$\left|\alpha - \frac{p}{q}\right| \geq \frac{1}{n_0 q}\,.$$

(2) Suppose α is an irrational real. Show that for any $n \in \mathbb{N}$, there is a rational number $\frac{p}{q}$ with $1 \leq q \leq n$, s.t.,

$$\left|\alpha - \frac{p}{q}\right| < \frac{1}{nq}\,.$$

(Hint: Pigeonhole principle.)

Finally, what do the above two properties characterize ?

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