COL 764 - Information Retrieval and Web Search
Assignment 0

Notes:

- This assignment is mandatory for everyone willing to attend this course.
- This assignment has two parts - HPC Verification and Statistics Questions.
- Your answers have to be a PDF submission –preferably prepared using LaTeX. *Do not submit handwritten, scanned sheets for this assignment.*
- Due date: 11:59 PM Sunday, 4th October, 2020
- **Total Marks: 0**

1. **HPC Verification**
   For this assignment, we require you to submit the details regarding your HPC account that you'll be using for the duration of this course. If you do not have a valid HPC account, please get it approved before the due date of this assignment.

   Submission Guidelines: The form link is available here. Note that this link is only accessible after you login with your IITD credentials on Microsoft.

   (a) The form contains basic questions regarding the validity of your HPC account.

   (b) If you are unable to get a valid account before the due date, then you must notify the instructor as soon as possible.

   (c) At the current moment, we have decided that all the submissions will be evaluated on HPC. Hence, it is advisable if you run a *trial* Python/C++ script before the assignment due date.

2. **Prob & Stats Questions**
   To acquaint you with the basics of probability.

   (a) The flow of traffic at certain street corners can sometimes be modeled as a sequence of Bernoulli trials by assuming that the probability of a car passing during any given second is a constant p, $0 \leq p \leq 1$, and that there is no interaction between the passing of cars at different seconds. If we treat seconds as indivisible time units, the Bernoulli model applies. Suppose a pedestrian can cross the street only if no car is to pass during the next k seconds (for some $k \geq 2$). Derive the expression for the probability that the pedestrian has to wait for exactly $k + 1$ seconds before starting to cross.

(b) The random pair (x, y) has the distribution:

		X		
		1	2	3
Y	2	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{12}$
	3	$\frac{1}{6}$	0	$\frac{1}{6}$
	4	0	$\frac{1}{3}$	0

i. Show that X and Y are dependent.

ii. Give a probability table for random variables U and V that have the same marginals as X and Y and are *independent*.

(c) Let X and Y be any two random variables, and define:

$$X \wedge Y = \min(X, Y), \text{ and } X \vee Y = \max(X, Y).$$

Show that

$$\mathbb{E}[X \vee Y] = \mathbb{E}[X] + \mathbb{E}[Y] - \mathbb{E}[X \wedge Y]$$

Submission Guidelines: Please submit your answers as a pdf document. In case your submission contains photographs of hand-written pages, make sure that the images are clear and combined into a single pdf.

The submission link is available on Moodle.