

**Mathematical For Data Science**  
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**Spring 2023**  
**Assignment # 2**

**Q1).** Three different software packages are used for big data analysis having probabilities of 0.1, 0.2, and 0.3 of crashing, respectively. All three packages work independently. What is the probability?

- I. That none of the three crashes.
- II. That all three crashes.
- III. That exactly two of the three crashes.
- IV. That At least one of the three crashes.
- V. That At most one of the three crashes.

**Q2).** Find the distribution function and sketch its graph of the random variable  $X$  whose probability density is given by

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 \leq x < 2 \\ 0 & \text{elsewhere} \end{cases}$$

**Q3).** For what values of  $k$  and  $m$  does the following augmented matrix has:

- |                           |                           |
|---------------------------|---------------------------|
| a) Unique Solution        | b) One-parameter Solution |
| c) Two-parameter Solution | d) No Solution            |

For each case where possible write the solution(s) of the system as well.

$$A = \begin{bmatrix} k & 0 & m & 2 \\ k & k & 4 & 4 \\ 0 & k & 2 & m \end{bmatrix}$$

**Q4).** A software takes 14 to 19 minutes randomly to run a specific program, then find,

- I. The p.d.f and c.d.f representing above event, also sketch the graph of both p.d.f and c.d.f.
- II. The probability that the software takes at most 16 minutes.
- III. The probability that the software takes at least 15 minutes.
- IV. The probability that the software takes exactly 18 minutes.
- V. The probability that the program takes between 15 to 17 minutes.
- VI. The expectation and Variance.

**Q5).** Identify Pivot Columns of following Matrices.

$$A = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 5 & 0 \\ 0 & 0 & 0 \\ 1 & 3 & 1 \end{bmatrix}$$