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FUZZY SEQUENCING PROBLEMS WITH PENTAGONAL FUZZY NUMBERS USING RANKING TECHNIQUE

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ABSTRACT:

In this paper we consider fuzzy sequencing problem where processing time taken as pentagonal fuzzy number. For finding the solution using Ranking method and fuzzy sequencing problem. Can be converted into a crisp valued sequencing problem. Also find the optimal solution.

KEYWORDS:

Pentagonal fuzzy numbers, Fuzzy sequencing problem. Fuzzy operations. Fuzzy optimal solution.

INTRODUCTION:

Decision Making is One of the important thing which plays a major in our daily life. Decision Making using Mathematical problem gives optimal solution in Many fields. One of the important problem is a job sequencing problem. Job sequencing problem has become a major problem in the computer field. Finding optional solution for the sequencing problem is one of the main application in operation research. Also find optiomal sequence and minimizing the time of the Machines. Johnson (1954) was the first of the machines, for production fielding. Later many authors investigated about the job sequencing problem like Smith (1967) and Dudek. In recent years fuzzy sets has been introduced in the job sequencing problem. to find optimization. In this paper. We investigate fuzzy sequencing problem with pentagonal fuzzy number.

Definitions and Formulations:-

Fuzzy Set:

A fuzzy set $\tilde{M}$ of X is defined by $\tilde{M}$={(x, μ (x)/XEX} where $\mu_{\tilde{M}}(x)$:x-[0,1] is said to be membership function of M and $\mu_{\tilde{M}}(x)$ is denoted by degree of membership. i.e.X E M.

PENTAGONAL FUZZY NUMBER:

A pentagonal fuzzy number is denoted by (M_1,M_2,M_3,M_4,M_5) where M_1,M_2,M_3,M_4,M_5 are real number and its membership function $\mu_{\tilde{M}}(x)$ as.

$$\mu_{\tilde{M}}(x)\begin{cases} \frac{s-M1}{M2-M1} \text{ for } M1 \le x \le M2 \text{ for} \\ \frac{s-M2}{M3-M4} \; M2 \le x \le M3 \text{ for } M3 \\ \frac{s-M3}{M4-M3} \le x \le M4 \\ 1 \text{ for } x=M_4 \\ \frac{M5-s}{M5-M4} \text{ for } M4 \le x \le M5 \end{cases}$$

$$0 \qquad \text{for } x > M5$$

Where $\mu_{\tilde{M}}(x)$ satis fies the conditions.

(i) $\mu_{\tilde{M}}(x)$ is continuous mapping from R to [0,1]

(ii) $\mu_{\tilde{M}}(x)$ =0 for every x c([−∞, M1])

(iii) $\mu_{\tilde{M}}(x)$ is strictly increasing and continuous on $[M_1,M_2]$ and $[M_2,M_3]$

(iv) $\mu_{\tilde{M}}(x)$ = 1 for every x c $[M_3,M_4]$

(v) $\mu_{\tilde{M}}(x)$ is strictly decreasing and continues on $[M_4,M_5]$

(vi) $\mu_{\tilde{M}}(x)$ =0 for every x c [M5,∞]

∝-cut:

The ∝ -cut of a fuzzy set M is a crisp set defined by

$M_s = \{x \subset x\ \mu_N(x) \geq \propto\}$

RANKING OF PENTAGIONAL FUZZY NUMBERS:-

A proven way for compare the fuzzy number by the use of raking function R:F (R) → R which maps each pentagonal fuzzy number into a real number.

For pentagonal fuzzy numbers

$\tilde{M} \approx =(M_1, M_2, M_3, M_4, M_5)$

$\approx ([M_2, M_3, M_4], \propto, þ) \subset F(R),$

Racking function

R:F(R) → R is defined by graded mean as $R(\tilde{M})$

$$=\left(\frac{M2+M3+M4}{3}\right) + \left(\frac{þ-\propto}{4}\right)$$

Now, We compare any two pentagonal fuzzy number

$\tilde{M} \approx \{M_1, M_2, M_3, M_4, M_5\} \approx ([M_2, M_3, M_4], \propto_1, þ_1)$

$\tilde{N} = \{N_1, N_2, N_3, N_4, N_5\} \approx ([N_2, N_3, N_4], \propto_2, þ_2) \subset F(R)$

We have the following

(i) $\tilde{M} \leq \tilde{N}$ if and only if $R(\tilde{M}) \geq R(\tilde{N})$

(ii) $\tilde{M} \leq \tilde{N}$ if and only if $R(\tilde{M}) \leq R(\tilde{N})$

(iii) $\tilde{M} \approx \tilde{N}$ if and only if $R(\tilde{M}) = R(\tilde{N})$

(iv) $\widetilde{M} - \widetilde{N} \approx 0$ if and only if $R\,\widetilde{M} - R\,(\widetilde{N}) = 0$

OPERATIONS ON PENTAGIONAL FUZZY NUMBERS:

For any two arbitrary pentagonal fuzzy numbers.

$\widetilde{M} = \{M_1, M_2, M_3, M_4, M_5\}$, $\widetilde{N} = \{N_1, N_2, N_3, N_4, N_5\}$

(i) Add

$\widetilde{M} + \widetilde{N} \approx \{M_1, M_2, M_3, M_4, M_5\} + \{N_1, N_2, N_3, N_4, N_5\}$

$\approx [\, M_2, M_3, M_4\,], \propto_{1,}\, þ_{1,}) + \approx ([\, N_2, N_3, N_4\,], \propto_{2,} þ_{2,})$

$\approx ([M_2+N_2, M_3+N_{3,}\, M_4+N_4], \max\{\propto_{1,}\, þ_2\}, \max\{þ_{1,}, þ_2\}$

(ii) Subtract

$\widetilde{M} + \widetilde{N} \approx ([M_2-N_4, \quad M_3-N_{4,} \quad M_4-N_2\,], \max\{\propto_{1,} \propto_{2,}\}, \max\{þ_{1,}, þ_2\}$

ALGORITHM

Processing of n jobs through two machines.

Given there are 'n' jobs say $A_1, A_2 \ldots A_n$ be processed through 2 machines say M_1, M_2, Let tij be fuzzy processing time by i^{th} job to machine. Then we find optimal sequence, total Elapsed time and idle time on Machines. Here fuzzy times are considered as pentagonal fuzzy number.

PROCEDURE FOR SOLVING PENTAGIONAL FUZZY SEQUENCING PROBLEM

Step:1

Using Ranking technique approach to the fuzzy sequencing problem

Step:2

To find optimal sequence for the fuzzy sequence problem is determined.

Step:3

Determine Total Elapsed fuzzy time and also the fuzzy idle time on machines.

Example:

Consider the fuzzy sequencing problem. Here processing time of 5 tasks jobs is given whose elements are fuzzy elements that characterize the variables that are replaced by pentagonal fuzzy numbers. The problem is then solved by processing n jobs through two machines.

Table:1

Tasks	Machine A	Machine B
1	Very Good	Low
2	Good	Very Low
3	Low	Medium
4	Very Low	Very Good
5	Medium	Good

Tabld:2 Quantitative data:-

The variables showing the data value is converted into quantitative data using full table. The processing time varies between 3 to 42 the minimum possible value is taken as 3 and the maximum possible value is take as 42.

Very Low	3,4,5,6,7
Low	9,11,13,15,17
Medium	18,19,20,21,22
Good	24,26,28,30,32
Very Good	34,36,38,40,42

Solution:

Table:3

Task	Machine A	Machine B
1	34,36,38,40,42	9,11,13,15,17
2	24,26,28,30,32	3,4,5,6,7
3	9,11,13,15,17	18,19,20,21,22

4	3,4,5,6,7	34,36,38,40,42
5	18,19,20,21,22	24,26,28,30,32

Convert the fuzzy pentagonal number

M≈(a1,a2,a3,a4,a5)into M≈[a2,a3,a4],
∝,þ)

Table:4 Converted Table:-

Task	Machine A	Machine B
1	([36,38,40], 2,2)	([11,13,15],2,2)
2	([26,28,30], 2,2,)	([4,5,6], 1,1)
3	([11,13,15,], 2,2)	(19,20,21], 1,1)
4	([4,5,6], 1,1)	([36,38,40], 2,2)
5	([19,20,21], 1,1)	([26,28,30], 2,2,)

Table:5 Fuzzy optional sequence

4	3	5	1	2

Table:6 Calculation Part.

Task	Machine A		Machine B	
	Time In	Time Out	Time In	Time Out
4	([0,0,0], 0,0)	([4,5,6], 1,1)	([4,5,6], 1,1)	([40,43,46],2,2)
3	([4,5,6], 1,1)	([15,18,21],2,2)	([40,43,46],2,2)	([59,63,67], 2,2)
5	([15,18,21],2,2)	([34,38,42], 2,2)	([59,63,67], 2,2)	([85,91,97], 2,2)
1	([34,38,42],2,2)	([70,76,82],2,2)	([85,91,97], 2,2)	([96,104,112],2,2)
2	([70,76,82],2,2)	([96,104,112],2,2)	([96,104,112],2,2)	([100,109,118],2,2)

Total Elapsed Time = ([100,109,118], 2,2)

= 109 hrs.

Idle time on Machine A = ([100,109,118], 2,2) – ([96,104,112], 2,2)

= 5 hrs. Idle time

on Machine B = 2 hrs

CONCLUSION:

In this paper, we have solved job sequencing problem with fuzzy processing times considered as pentayonal numbers. A numerical example has, been considered and solved by Ranking Technique Fuzzy sequencing problem is simple to understand and it helps to develop decision makers in real life situation.

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