IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

FINDING MINIMUM TOTAL ELAPSED TIME IN A SEQUENCING PROBLEM BY A NEW ZERO IDENTIFIER METHOD

V.T.Lakshmi
Department of Mathematics, Vinayaka Mission's Kirupananda Variyar Engineering College,
Vinayaka Mission's Research Foundation (Deemed to be University), Salem, Tamil Nadu, India
lakshmivt@vmkvec.edu.in

Abstract

The sequencing technique is used to obtain the sequence of various machines, which minimize the total time required to process the jobs on various machines. In this paper, we have proposed a new method known as the zero identifier method by using an Excel solver to solve the job sequencing problem and find the total elapsed time and idle time on each machine, with illustrated examples to find the sequencing of n jobs on two machines and three machines, respectively.

Keywords

Sequencing, processing time, total elapsed time, idle time & zero identifier method

Introduction

The goal of sequencing problems is to determine the best technological sequence in which to perform a number of tasks on a limited number of service facilities in order to optimise the total time spent or total cost, among others. The effectiveness of these situations depends on the order or sequence in which the duties are carried out. Cost, time, and other factors can all be used to quantify efficacy. An example of a sequencing jobs issue that might occur at a manufacturing facility is scheduling maintenance in a factory, running programmes on a computer centre, serving customers in a bank, and so on. There are many algorithms proposed for the job sequencing problem. Johnson's algorithm is most commonly used for job sequencing, but it has some restrictions. In this paper, I introduce a new method known as the "zero identifier method" by using the Excel solver without converting n-machine problems into a two-machine problem to find the total elapsed time and idle time of each machine.

Definitions

Processing time: A job's processing time is the amount of time it takes for a specific machine to process it.

Total elapsed time: Total elapsed time is the amount of time needed to finish each job in a sequence, from beginning to end.

Idle time: Idle time is a time when a machine remains idle and nothing has to be done.

No passing rule: If n jobs are to be processed through two machines A and B in the order AB, then this indicates that the passing is not permitted, and each job will go to machine A first and then to machine B.

Zero identifier method to solve job sequencing problem

Suppose we want to process n jobs on two machines, M1 and M2 in order M1M2.To find the minimum elapsed time by using the "zero identifier method by the following procedure

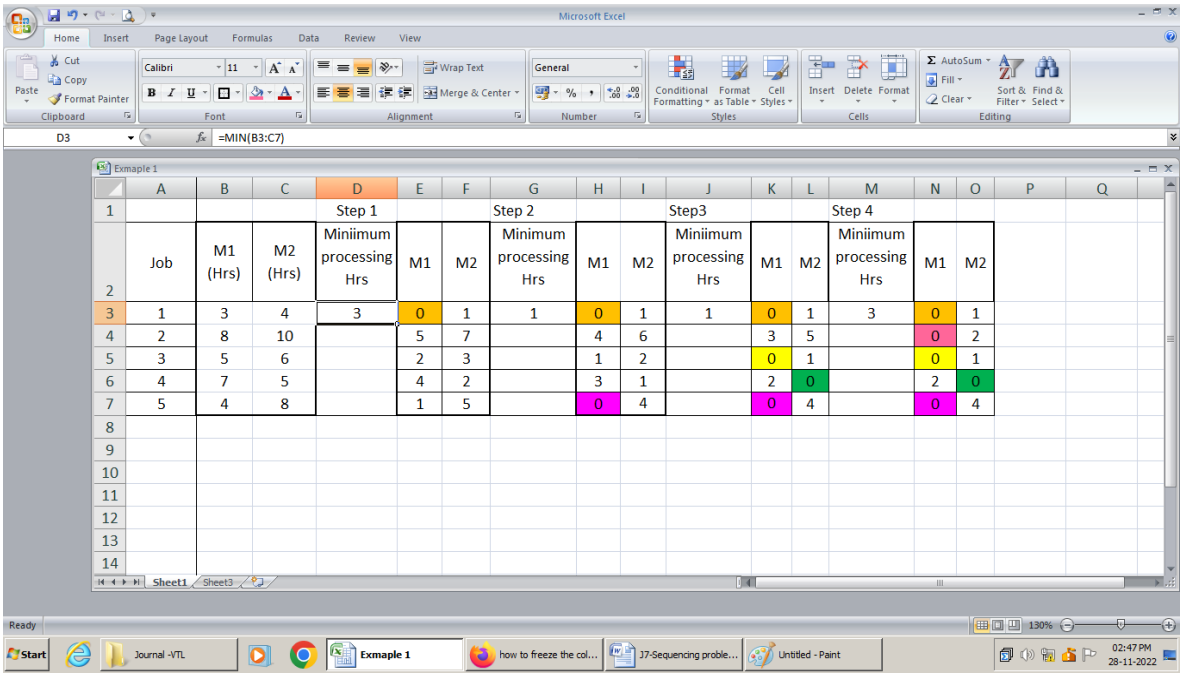
- Identify the minimum processing time.
- Subtract all elements from this minimum processing time.
- Identify zeros; they may occur in machine 1 or machine 2 or both.
- If zeros occur in the first machine, give preference to machine 1, and the order of the sequence is from left to right.
- If zeros appear in the second machine or third machine, in which the sequence is from right to left,
- Cancel the jobs already assigned and repeat the process until all jobs have been assigned.
- Finally, for each machine, compute the time in and time out.
- Find the total elapsed time and idle time on each machine with the following examples.

Example

Calculate the total elapsed time and idle time on each machine from the following table

Job	1	2	3	4	5
M1	3	8	5	7	4
M2	4	10	6	5	8

Apply the above procedure in an Excel sheet, we get the following table

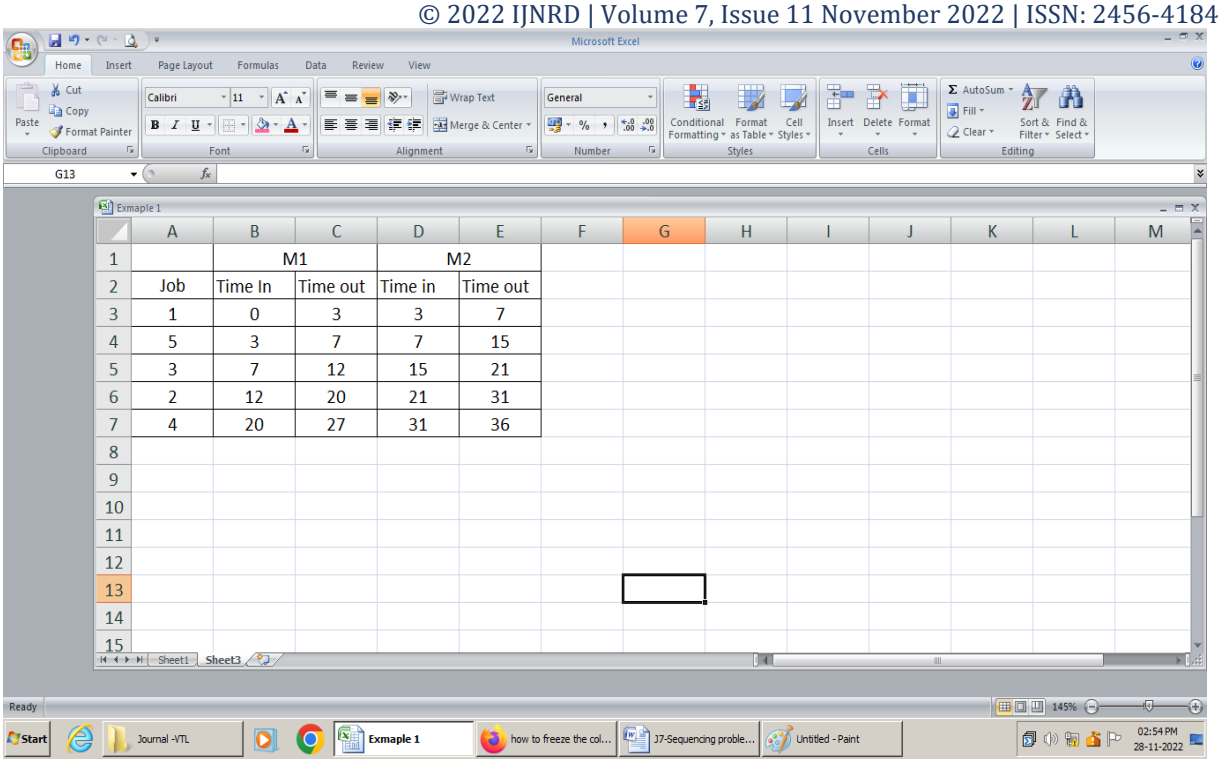


			Step 1			Step 2			Step3			Step 4		
Job	M1 (Hrs)	M2 (Hrs)	Miniimum processing Hrs	M1	M2	Minimum processing Hrs	M1	M2	Miniimum processing Hrs	M1	M2	Miniimum processing Hrs	M1	M2
1	3	4	3	0	1	1	0	1	1	0	1	3	0	1
2	8	10		5	7		4	6		3	5		0	2
3	5	6		2	3		1	2		0	1		0	1
4	7	5		4	2		3	1		2	0		2	0
5	4	8		1	5		0	4		0	4		0	4

From the above table, the order of sequence is

1	5	3	2	4

To calculate time in and time out for each machine as follow and to find the total elapsed time and idle time on each machine



		M1		M2	
	Job	Time In	Time out	Time in	Time out
	1	0	3	3	7
	5	3	7	7	15
	3	7	12	15	21
	2	12	20	21	31
	4	20	27	31	36

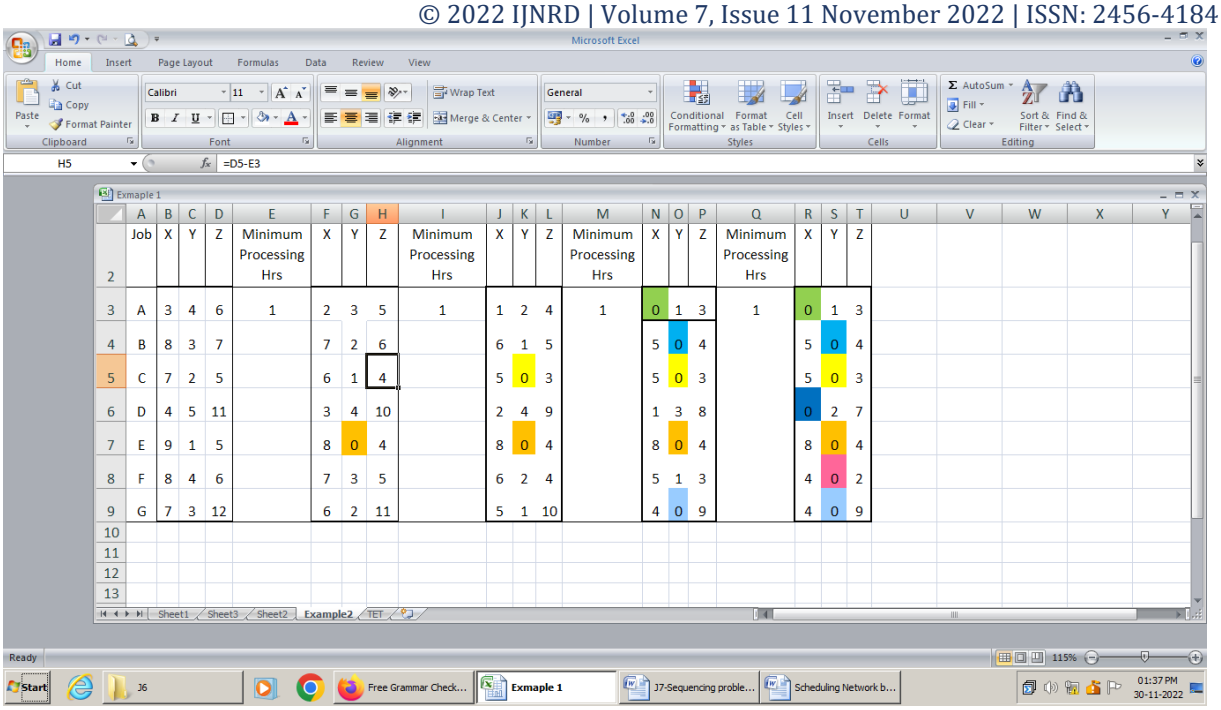
From the above table, we get
Total elapsed time = 36 Hrs
Idle time on Machine1 is 36-27 = 9 Hrs
Idle time on Machine2 is 3 Hrs

Example

Find the sequence that minimizes the total elapsed time required to complete the following tasks on the machines in the order 1-2-3.Find also the minimum total elapsed time (Hrs) and the idle time on the machine

Task	A	B	C	D	E	F	G
Machine 1	3	8	7	4	9	8	7
Machine 2	4	3	2	5	1	4	3
Machine 3	6	7	5	11	5	6	12

Here, we cannot convert a three-machine problem into a two-machine problem. Apply the above procedure in an Excel sheet to form an order of sequence using the zero identifier method.

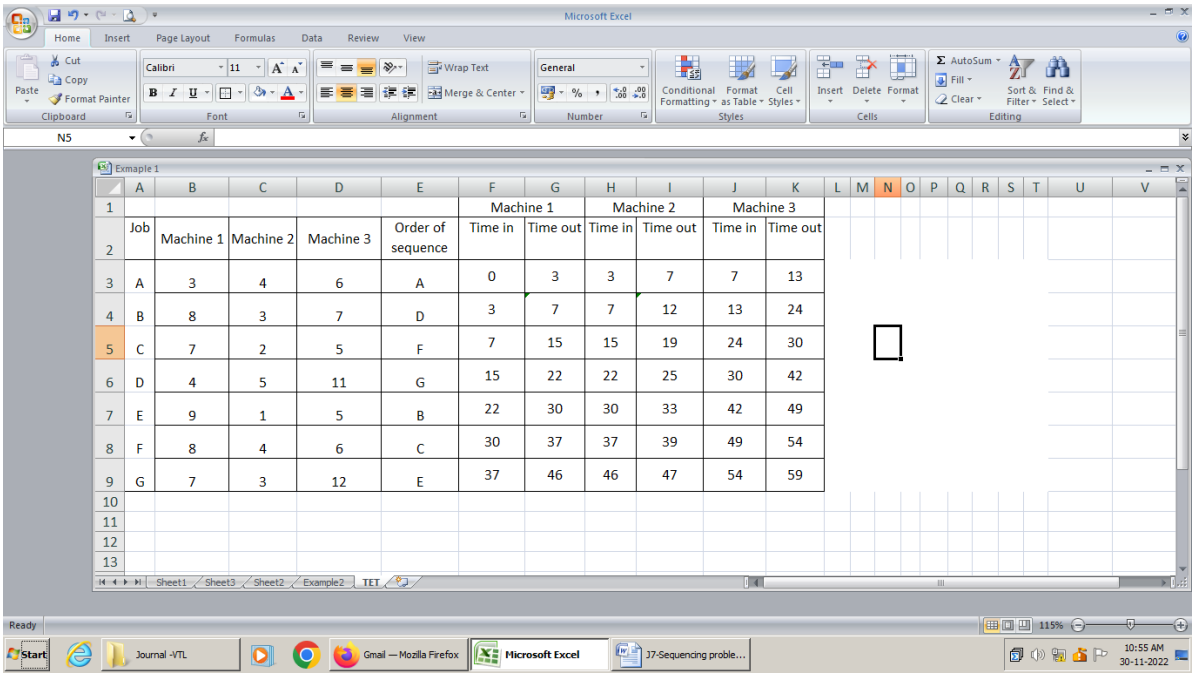


Job	X	Y	Z	Minimum Processing Hrs	X	Y	Z	Minimum Processing Hrs	X	Y	Z	Minimum Processing Hrs	X	Y	Z	Minimum Processing Hrs	X	Y	Z
A	3	4	6	1	2	3	5	1	1	2	4	1	0	1	3	1	0	1	3
B	8	3	7		7	2	6		6	1	5		5	0	4		5	0	4
C	7	2	5		6	1	4		5	0	3		5	0	3		5	0	3
D	4	5	11		3	4	10		2	4	9		1	3	8		0	2	7
E	9	1	5		8	0	4		8	0	4		8	0	4		8	0	4
F	8	4	6		7	3	5		6	2	4		5	1	3		4	0	2
G	7	3	12		6	2	11		5	1	10		4	0	9		4	0	9

From the above table, the order of sequence is

A	**D**	**F**	**G**	**B**	**C**	**E**

To calculate time in and time out for each machine as follows and to find the total elapsed time and idle time on each machine



					Machine 1		Machine 2		Machine 3	
Job	Machine 1	Machine 2	Machine 3	Order of sequence	Time in	Time out	Time in	Time out	Time in	Time out
A	3	4	6	A	0	3	3	7	7	13
B	8	3	7	D	3	7	7	12	13	24
C	7	2	5	F	7	15	15	19	24	30
D	4	5	11	G	15	22	22	25	30	42
E	9	1	5	B	22	30	30	33	42	49
F	8	4	6	C	30	37	37	39	49	54
G	7	3	12	E	37	46	46	47	54	59

From the above table,
Total elapsed time = 59Hrs
Idle time on Machine1 =59-46 = 13Hrs
Idle time on Machine2 =3+3+3+5+4+7+12=37 Hrs
Idle time on Machine3 = 7 Hrs

Conclusion

In this paper, we introduce a new method called the zero identifier method to form a sequence of n jobs on two machines and n jobs on three machines for solving the job sequencing problem. However, we cannot convert the three-machine problem into a two-machine problem. Identify zero in all of the

machines' processing times and form the order of sequence in n jobs using two and three machines with the same minimum elapsed time and idle time by the existing method.

REFERENCES

[1] Iyer P. Sankara (2008). Operations Research, Tata McGraw-Hill Publishing Company Limited, India, 194-201, ISBN (13): 978-0-07-066902-4, ISBN (10): 0-07-066902-3

[2] Job sequencing problem using deviation technique, Anita B.Watekar, Research Journal of Mathematical and Statistical Sciences, ISSN 2320-6047, Vol. 5(5), 9-13, May (2017)

[3] Heuristics Algorithms for Job Sequencing Problems, K. Karthikeyan, Global Journal of Science Frontier Research, 36 Vol.10 Issue 4(Ver1.0), September 2010

[4] Path optimization algorithm for network problems using job sequencing technique, Punit Kumar Singh and Dr. Rakesh Kumar, International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.3, May 2012

[5] Recent trends in sequencing and scheduling, Manisha Sharma1, Himansha Sharma and Meenakshi Sharma, Malaya Journal of Matematik, Vol. S, No. 1, 75-78, 2018

[6] Gupta Srikant, Ali Irfan and Ahmed A. (2016). A New Algorithm for Solving Job Shop Sequencing Problem. *Int.J. of Comp. Sci. Engg.(IJCSE)*, 5(2), 93-100.

[7] Resource Management Technique, Prof.V.Sundaresan, Prof.K.S.Ganapathy Subramanian, Prof.K.Ganesan, A.R.Publication, Chennai

[8] Operations Research, Handy A. Taha

[9] S.K. Gupta, N jobs and m machines job shop problem with sequence dependent setup Times, International Journal of Production Research, 20(1982), 643–656.