International Journal of Innovative Research in Science and Engineering
Volume 08, Issue 04, 2022
www.ijirse.com
ISSN: 2454-9665

A Computational Study on Assignment Problem With Ramanujan Primes: Case(I)

K.V.L.N.Acharyulu[1] & P.Prasanna Anjaneyulu[2]

[1]*Associate Professor,*

Dept. of Mathematics, Bapatla Engineering College,Bapatla.

[2]*Associate Professor,*

Department of S & H, Vasireddy Venkatadri Institute of Technology, Nambur, India.

Abstract

The purpose of the study is to discuss a unique instance of the Assignment Problem. By treating Ramanujan Primes as cost assignments, it is created. Some examples are looked into considerable detail. Few encouraging findings have been made. The generalised optimum assignments are found in this study. Detailed computational values in the respective tables in various scenarios are provided.

1.INTRODUCTION:

Ramanujan modified an existing result. i.e the function $\pi(x) - \pi\left(\frac{x}{2}\right) \geq 1,2,3,4,5,\ldots \text{for all} x \geq 2,11,17,29,41,\ldots \text{respectively,}$Where $\pi(x)$is the prime-counting function which is equal to the number of primes less than or equal to *x*. The converse of this result is the definition of Ramanujan primes: The n^{th} Ramanujan prime is the least integer R_n for which $\pi(x) - \pi\left(\frac{x}{2}\right) \geq n, for all x \geq Rn$. It is noted that the integer R_n is necessarily a prime number: $\pi(x) - \pi\left(\frac{x}{2}\right)$and $\pi(x)$must increase by obtaining another prime at $x = R_n$. Since $\pi(x) - \pi\left(\frac{x}{2}\right)$ can increase by at most 1,$\pi(Rn) - \pi\left(\frac{Rn}{2}\right) = n$.Bounds and an Asymptotic formula are valid for all n≥1, the bounds $2n \ln 2n < Rn < 4n \ln 4n$hold. If n>1, then also $p_{2n} < Rn < p_{3n}$where p_n is the n^{th} prime number.

As *n* tends to infinity to the 2*n*th prime, i.e., $R_n \sim p_{2n}$ $(n \to \infty)$.

2.HUNGARIAN METHOD:

Denes konig and Jeno, two Hungarian mathematicians, were familiar with this technique. The Hungarian approach is the best source of combinatorial optimization techniques for solving a wide range of challenging assignment problems. Harold Kuhn created and published the algorithm in 1955.

He proclaimed the algorithm's name to be Hungarian algorithm. James Munkres examined that algorithm in 1957 and determined that it is strongly polynomial. Many mathematicians[1-37] have studied the applicability of a few operations research approaches, and they are helpful in tracing an optimal solution that satisfies all the requirements. One such successful and successful optimization technique is the Hungarian Method.

2.1 METHODOLOGY:

Hungarian method is one of the reputed methods for getting fine assignment to the given assignment problem.

Phases-(i): It is the first and foremost duty to check whether the given assignment problem is balanced or not. If it is not a balanced assignment problem, It should be converted as balanced assignment problem by introducing necessary dummy rows or dummy columns with zero cost values.

Phase(ii): In this phase,identify minimum element in the first row and subtract it from the remaining elements in the first row. The same process is adopted to the remaining all rows. In the same manner identify minimum element in the first column and subtract it only from the remaining elements in the first column. It is extended to the remaining all columns.

Phase(iii):By examining the rows consecutively to trace exactly the one zero in a row and make an assignment to the single zero by encircling it.The remaining other zeroes are crossed out in its column. Reiterate the same process till we reach the stage of having all zeroes of rows and columns are either encircled or crossed out.

Phase(iv): Optimality condition stands on the criteria in which the number of assigned zeroes is equal to number of rows/columns. If the current phase is satisfying the optimality condition then the positions of assigned zeroes will supply the optimum assignment and the sum of the cost values of the respective positions will provide optimum solution (i.e.) Total minimum cost of the assignment problem.

Phase (v):At the stage of not satisfying optimality condition at any cycle, consider the concept of drawing minimum number of lines covering all zeroes including assigned zeroes and crossed out zeroes. It is always better to take the minimum number of lines less than or equal to the number of rows/columns

Phase (vi): Consider minimum element from the uncovered elements which will be subtracted from all the uncovered elements. This minimum element will be added at the position of intersection of horizontal and vertical lines. The remaining elements which are crossed by a single line remain unchanged. Repeat the process from phase (iv) until we reach the optimum solution.

International Journal of Innovative Research in Science and Engineering
Volume 08, Issue 04, 2022
www.ijirse.com
ISSN: 2454-9665

3. BASIC ASSIGNMENT MODEL:

3.1 Case(a) :

The mathematical model of assignment problem in case (i) is defined as

$$Min / Max\ Z = \sum_{i=1}^{7}\sum_{j=1}^{7} c_{ij} x_{ij}$$

Subject to the constraints:

$$\sum_{i=1}^{7} x_{ij} = 1 \text{ for j=1,2,3,4,5,6 and 7}$$

$$\sum_{j=1}^{7} x_{ij} = 1 \text{ for i=1,2,3,4,5,6 and 7}$$

x_{ij} = either 0 or 1 for all i,j

Here x_{ij} denotes the assignment of i^{th}resourcetoj^{th} activity with the successive numbers of Ramanujan primes row wise.

Table-1- Tabular Form of 7x7 Assignment Problem with Ramanujan primes

7x7	1	II	III	IV	V	VI	VII
A	2	67	151	239	347	431	569
B	11	71	167	241	349	433	571
C	17	97	179	263	367	439	587
D	29	101	181	269	373	461	593
E	41	107	227	281	401	487	599
F	47	127	229	307	409	491	601
G	59	149	233	311	419	503	607

Table-2: Hungarian Method With 7x7 Assignment Problems in Minimization Case with cycle-1

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Minimization Type	C1	(A,III), (B,II), (C,VI),	P_{42},P_{43},P_{44},P_{45},P_{46}, P_{47},P_{52},P_{53},P_{54},P_{55}, P_{56}, P_{57},P_{62},P_{63},P_{64},	5	(A,III), (B,IV), (C,VI),	1965

(7x7)		(D,I), (G,VII)	P_{65},P_{66},P_{67}		(D,V), (E,II), (F,I), (G,VII).	

Table-3: Hungarian Method With 7x7 Assignment Problems in Minimization Case with cycle-2

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Minimization Type (7x7)	C2	(A,III),(B,II), (C,VI),(D,I), (G,VII)	P_{42},P_{44},P_{45},P_{46}, P_{47},P_{52},P_{54},P_{55},P_{56}, P_{57},P_{62},P_{64}, P_{65},P_{66},P_{67}	6	(A,III), (B,IV), (C,VI), (D,V), (E,II), (F,I), (G,VII).	1965

Table-4: Hungarian Method With 7x7 Assignment Problems in Minimization Case with cycle-3

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Minimization Type (7x7)	C3	(B,IV),(C,VI), (D,III),(E,II), (F,I), (G,VII)	P_{11},P_{12},P_{13},P_{14}, P_{15},P_{16},P_{17}	6	(A,III), (B,IV), (C,VI), (D,V), (E,II) ,(F,I), (G,VII).	1965

International Journal of Innovative Research in Science and Engineering
Volume 08, Issue 04, 2022
www.ijirse.com
ISSN: 2454-9665

Table-5: Hungarian Method With 7x7 Assignment Problems in Minimization Case with cycle-4

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Minimization Type (7x7)	C4	(A,III),(B,IV),(C,VI),(D,V),(E,II),(F,I),(G,VII)	*	*	(A,III),(B,IV),(C,VI),(D,V),(E,II),(F,I),(G,VII)	1965

Table-6: Hungarian Method With 7x7 Assignment Problems In Maximization Case with cycle-1

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	C1	(A,VII),(E,III),(F,IV),(G,I)	P_{11},P_{12},P_{13}, P_{14}, P_{15}, P_{16}, P_{21}, P_{22},P_{23}, P_{24}, P_{25}, P_{26}, P_{31}, P_{32},P_{33}, P_{34}, P_{35}, P_{36}, P_{41},P_{42},P_{43}, P_{44}, P_{45}, P_{46}	4	(A,VII),(B,I),(C,II),(D,VI),(E,III),(F,IV),(G,V)	2091

Table-7: Hungarian Method With 7x7 Assignment Problems inMaximization Case with cycle-2

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	C2	(A,VII), (E,III), (F,IV), (G,I)	P_{11},P_{12},P_{13}, P_{14}, P_{15}, P_{16}, P_{21}, P_{22},P_{23}, P_{24}, P_{25}, P_{26}, P_{31}, P_{32},P_{33}, P_{34}, P_{35}, P_{36}, P_{41},P_{42},P_{43}, P_{44}, P_{45}, P_{46}	4	(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)	2091

Table-8: Hungarian Method With 7x7 Assignment Problems inMaximization Case with cycle-3

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	C3	(A,VII), (B,I), (E,III), (F,IV), (G,II),	$P_{12}$$P_{13}$, P_{14}, P_{15},P_{16}, P_{22},P_{23}, P_{24},P_{25}, P_{26}, P_{32},P_{33},P_{34}, P_{35}, P_{36},, P_{42},P_{43}, P_{44}, P_{45}, P_{46}	5	(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)	2091

Table-9: Hungarian Method With 7x7 Assignment Problems

In Maximization Case with cycle-4

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	**C4**	**(B,I), (C,VII), (D,VI), (E,III), (F,IV), (G,V)**	P_{11},$P_{12}$$P_{13}$, P_{14}, P_{15}, P_{16}, P_{31}, P_{32},P_{33},P_{34}, P_{35}, P_{36}	**6**	**(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)**	**2091**

Table-10: Hungarian Method With 7x7 Assignment Problems

In Maximization Case with cycle-5

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	**C5**	**(A,VII), (B,I), (C,IV), (D,VI), (E,III), (G,V)**	P_{11},P_{12} P_{15},P_{16}, ,P_{31}, P_{32}, P_{35}, P_{36}, P_{51},P_{52} P_{55},P_{56},P_{61}, P_{62}, P_{65}, P_{66},	**6**	**(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)**	**2091**

International Journal of Innovative Research in Science and Engineering
Volume 08, Issue 04, 2022
www.ijirse.com
ISSN: 2454-9665

Table-11: Hungarian Method With 7x7 Assignment Problems In Maximization Case with cycle-6

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	C6	(B,I), (C,VII), (D,VI), (E,III) (F,IV), (G,V)	$P_{12}P_{13}$, P_{15},P_{16}, P_{32},P_{33}, P_{35}, P_{36}	7	(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)	2091

Table-12: Hungarian Method With 7x7 Assignment Problems In Maximization Case with cycle-7

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	C7	(A,I), (C,V), (D,VI), (E,III) (G,II)	P_{21}, P_{22}, P_{24},P_{25}, P_{26}, P_{51}, P_{52},P_{54}, P_{55},P_{56} P_{61}, P_{62}, P_{64}, P_{65}, P_{66}	5	(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)	2091

Table-12: Hungarian Method With 7x7 Assignment Problems In Maximization Case with cycle-7

Objective Function Type	Cycle	Assigned Zero Positions	Positions Of Uncovered Elements	Minimum No. Of Lines In Cycle Wise	Optimal Assignment	Total Assignment Cost
Maximization Type (7x7)	C8	(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)	*	*	(A,VII), (B,I), (C,II), (D,VI), (E,III), (F,IV), (G,V)	2091

Table-4: Bottle Neck Method With 7x7 Assignment Problem in Minimization/Maximization

Objective Function Type	Optimal Assignment	Total Assignment Cost
Minimization (7x7)	(A,VII),(B,VI),(C,V),(D,IV),(E,III),(F,II),(G,I)	2051
Maximization (7x7)	(A,VII),(B,VI),(C,V),(D,IV),(E,III),(F,II),(G,I)	2051

4.Conclusions:

In this specific case study on assignment problem with Ramanujan primes, the following observations are made:

(i).Cycle by cycle and size by size, there is a regular change in the movement of uncovered elements .

(ii).All assigned zeros must be covered by a minimum number of lines, and any additional zeros play a significant part in many cycles as we go closer to the ideal situation.

(iii).The Hungarian approach and Bottleneck method successfully extract the potential Optimum Assignments and Total cost values in the scenarios of Minimization as well as in Maximization of this model.

Reference

[1].Alexander Schrijver, Theory of Linear and Integer Programming. John Wiley & Sons,1998

[2].Billy E. Gillett, Introduction to operations Research, Tata McGraw-Hill Publishing Company limited, New York,1979.

[3].Bland, Robert G. , "New Finite Pivoting Rules for the Simplex Method". Mathematics of Operations Research. 2 (2): 103–107. 1977.

[4].George B. Dantzig and Mukund N. Thapa.,Linear programming 1: Introduction. Springer-Verlag,1997.

[5].George B. Dantzig and Mukund N. Thapa., Linear Programming 2: Theory and Extensions. Springer-Verlag,2003.

[6]. S.D.Sharma, Operations Research, KedarNath Ram Nath&Co. ,1999.

[7].K.V.L.N.Acharyulu and NaguVadlana,Influence of G.P on Networks - A Scientific study on Case (I), International Journal of Computer Networking, Wireless and Mobile Communications, Vol. 3, Issue 2, pp. 83-92, 2013.

[8].K.V.L.N.Acharyulu and Maddi.N.Murali Krishna,Impact of A.P on Networks - A Computational study on Case (I), International Journal of Computer Networking, Wireless and Mobile Communications, Vol. 3, Issue 2, pp. 55-793-102, 2013.

[9].K.V.L.N.Acharyulu and Maddi.N.Murali Krishna, Some Remarkable Results in Row and Column both Dominance Game with Brown's Algorithm, International Journal of Mathematics and Computer Applications Research, Vol. 3, No.1, pp.139-150, 2013.

[10].K.V.L.N.Acharyulu,Maddi. N. Murali Krishna, SateeshBandikalla&NaguVadlana,(2013). A Significant Approach On A Special Case Of Game Theory, International Journal of Computer Science Engineering and Information Technology Research, Vol. 3, Issue 2, pp. 55-78, 2013.

[11].K.V.L.N.Acharyulu and Maddi.N.Murali Krishna,A Scientific Computation On A Peculiar Case of Game Theory in Operations Research, International Journal of Computer Science Engineering and Information Technology Research,Vol. 3 , No.1, pp.175-190, 2013.

[12].K.V.L.N.Acharyulu and NaguVadlana,Impact of G.P on Networks - A Computational Study on Case (II),International Journal of Computer Science Engineering and Information Technology Research, Vol. 3, Issue 3, Aug 2013, 241-250,2013.

[13].K.V.L.N.Acharyulu, Maddi.N.Murali Krishna & P. PrasannaAnjaneyulu ;A ScientificStudy On A Network With Arithmetic Progression On Optimistic Time Estimate, ActaCienciaIndica, Volume 40, No 2, 177-188, 2014.

[14].K.V.L.N.Acharyulu&I.Pothuraju ,A Peculiar Case In Game Theory- A Computational Study, International Journal of Scientific and Innovative Mathematical Research (IJSIMR), Volume 2, Issue 3, PP 269-280,2014.

[15].K.V.L.N.Acharyulu&I.Pothuraju ,A Special case in Network –G.P on optimistic time estimate, ActaCienciaIndica, Volume 40, No 3, 315-321, 2014.

[16].K.V.L.N.Acharyulu,Ch.ChandraSekaraRao&I.Pothuraju, AScientific Approach with Computational Study on Case(I), International Journal of Scientific andInnovative Mathematical Research (IJSIMR), Volume 2, Issue 12,PP 989-998,2014.

[17].K.V.L.N.Acharyulu&I.Pothuraju, Geometric Progression in Operations Research (PERT) –A Special Case Study, International Journal of Scientific and Innovative Mathematical Research (IJSIMR), Volume 2, Issue 1,PP 83-93,2014.

[18].K.V.L.N.Acharyulu, Maddi.N.Murali Krishna & P. PrasannaAnjaneyulu; Arithmetic Progression in Operations Research(PERT)-A Special case study,ActaCiencia Indica,Vol.40, No 3, 425-434, 2014.

[19].N.SeshagiriRao, K.Kalyani and K.V.L.N.Acharyulu, Threshold results for host –Mortal Commensal ecosystem with limited resources, Global Journal of Pure and Applied Mathematics, Volume10, No.6, PP:787-791,2014.

[20].K.V.L.N.Acharyulu, "A Special Case Study On 10x10 Symmetric Problem in Game Theory–Brown's Algorithm", ActaCienciaIndica, Volume.43, No.2, pp.141-148,2017.

[21].K.V.L.N.Acharyulu, "A Case Study On The Influence of Optimistic Time Estimate On A Network With Arithmetic Progression", International Journal of Advance research in science and Engineering, Volume.6, No.10, PP.1198-1205,2017.

[22].K.V.L.N.Acharyulu,"Arithmetic Progression on Most Likely Time Estimate -A case study",ActaCienciaIndica, Volume.43,No.2,pp.165-172,2017.

[23].K.V.L.N.Acharyulu, "Prime Problem In Game Theory – Brown's Algorithm",International Journal of Advance research in science and Engineering, Volume.6,No.10,PP.1206-1212,2017.

[24].K.V.L.N.Acharyulu, "A Problem in Game Theory with Fibonacci Numbers", International Journal of Advance research in science and Engineering, Volume.6, No.11, PP.1954-1960,2017.

[25].K.V.L.N.Acharyulu," A Game with non zero Triangular numbers",ActaCienciaIndica, Volume.43,No.4,pp.247-253,2017.

[26].K.V.L.N.Acharyulu,"Pessimistic Time Estimate With Arithmetic Progression", International Journal of Advance research in science and Engineering, Volume.6,No.11, PP.1961-1967,2017.

[27].K.V.L.N.Acharyulu, "A Special symmetric Game Problem with Triangular Numbers-Brown's Algorithm", ActaCienciaIndica, Volume.43,No.4,pp.221-227,2017 .

[28].K.V.L.N.Acharyulu, B.SaiPrasanna and B.SriSatyaRajani,‘A Special Case Study in LPP’,International Journal of Management, Technology and Engineering, Volume.8,Issue10, pp.1512-1521,2018.

[29].K.V.L.N.Acharyulu,A.Bhargavi and G.Sravani ‘A Peculiar Problem in Linear Programming Problem’ ,International Journal of Management, Technology and Engineering, Volume.8,Issue10,pp.1532-1540,2018.

[30].K.V.L.N.Acharyulu, B.Jayasree&Sk.Mubeena, ‘A Generalized problem in Linear programming problem’,International Journal of Management, Technology and Engineering, Volume.8,Issue10,pp.1541-1548,2018.

[31].K.V.L.N.Acharyulu, P.Hema and T.Vimala ‘A Generalized problem in Linear programming problem’,International Journal of Management, Technology and Engineering, Volume.8,Issue10,pp.1549-1556,2018.Fbodigiri

[32].K.V.L.N.Acharyulu, O.Nagaraju&G.Srikanth, Special Case in Assignment Problem with Ramanujan Primes, Journal of the Gujarat Research Society, Vol. 21, Issue 3, pp.368-377,October 2019.

[33].K.V.L.N.Acharyulu,V.Saritha&K.YaminiDevi,A Peculiar Case in Assignment Problem With Triangular Numbers,Journal of the Gujarat Research Society, Vol. 21, Issue 3, pp.378-389,October 2019.

[34].K.V.L.N.Acharyulu , Ch. Sri Lakshmi &Y.Anusha, Generalized Case in Assignment Problem With Lucas Numbers in Journal of the Gujarat Research Society, Vol. 21, Issue 3, pp.390-400,October 2019.

[35].K.V.L.N.Acharyulu , H. Mounika& CH. Raja Rajeswari Devi, A Variety Case in Assignment Problem With Tribonacci Numbers, Journal of the Gujarat Research Society, Vol. 21, Issue 3, pp.401-413,October 2019.

[36].K.V.L.N.Acharyulu, D.Jaswanth&D.Chiranjeevi ,An Exclusive Case in Assignment Problem With Fibonacci Numbers,Journal of the Gujarat Research Society, Vol. 21, Issue 3, pp.414-426,October 2019.

[37].K.V.L.N.Acharyulu,N.Phani Kumar, G.Srikanth&O.Nagaraju Special Ammensal Model with Monad Coefficient - A Logical Study,South East Asian J. of Mathematics and Mathematical SciencesVol. 16, No. 1 (April), pp. 97-104,2020.