Solution:

Since there are three machines in the original problem, two (m-1 =2) surrogate $F_2 \| C_{max}$ problems will be formed.

i. Surrogate Problem 1

Consider Machine M_1 as surrogate machine 1 (M_1') and Machine M_3 as surrogate machine 2 (M_2') as shown in Table below.

Table 4.6 First 2-machine Surrogate problem data using CDS Heuristic.

	j_1	j_2	j_3	j_4
$M_1' = M_1$	6	8	3	4
$M_2' = M_3$	4	4	4	2

Applying Johnson Rule, Set I = $\{j_3\}$, set II = $\{j_1, j_2, j_4\}$ or set II = $\{j_2, j_1, j_4\}$. Hence there are two possible sequences:

Sequence 1 = $\{j_3, j_1, j_2, j_4\}$ and, is given in Table 4.7.

Table 4.7 First sequence obtained and job's processing times.

	j_3	j_1	j_2	j_4
$M_1' = M_1$	3	6	8	4
$M_2' = M_3$	4	4	4	2

Using directed graph, the C_{max} calculations are shown in Figure 3.5

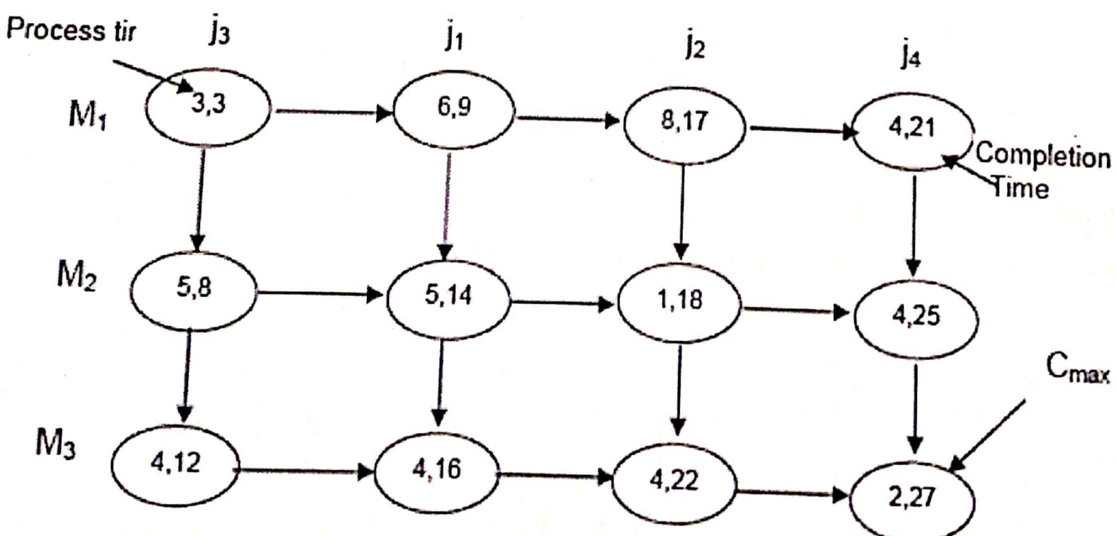

Figure 4.5 Directed Graph For Sequence/Schedule $\{j_3, j_1, j_2, j_4\}$

Sequence 2 = {j_3, j_2, j_1, j_4} and, is given in the Table 4.8.

Table 4.8 Second sequence obtained and job's processing time.

	J_3	j_2	j_1	j_4
$M_1' = M_1$	3	8	6	4
$M_2' = M_3$	4	4	4	2

Using directed graph, the C_{max} calculations are shown in Figure 3.6

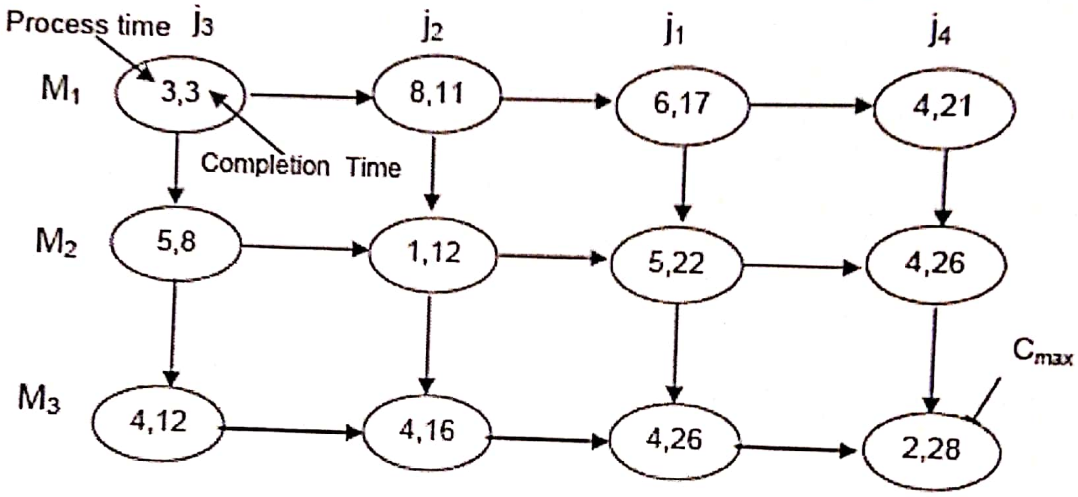

Figure 4.6 Directed graph for sequence/schedule {j_3, j_2, j_1, j_4}

ii. Surrogate Problem 2

From the problem data in Table, formulate 2-machine problem as under;

Table 4.9 Data for surrogate problem 2

	j_1	j_2	j_3	j_4
$M_1'=M_1+M_2$	11	9	8	8
$M_2'=M_2+M_3$	9	5	9	6

Applying Johnson rule; Set–I = {j_3}, and, Set-II = {j_1, j_4, j_2}. The Johnson sequence is, therefore, {j_3, j_1, j_4, j_2}. The computation of C_{max} is shown in Table 4.10

Table 4.10 C_{max} calculations using tabular method for sequence: {j_3, j_1, j_4, j_2}

Machine	j_3	j_1	j_4	j_2	C_3	C_1	C_4	C_2	C_{max}
M_1	3	6	4	8	3	9	13	21	
M_2	5	5	4	1	8	14	18	22	
M_3	4	4	2	4	12	18	20	26	26

The Gantt chart for schedule is shown in Figure 4.7

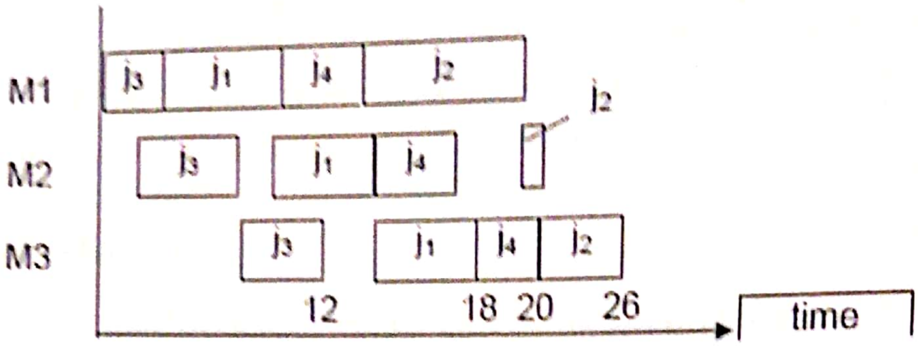

Figure 4.7 Gantt chart for sequence {j3, j1, j4, j2}.

The schedule {j3 , j1 , j4 , j2} is also presented by directed graph as shown in Figure 4.8

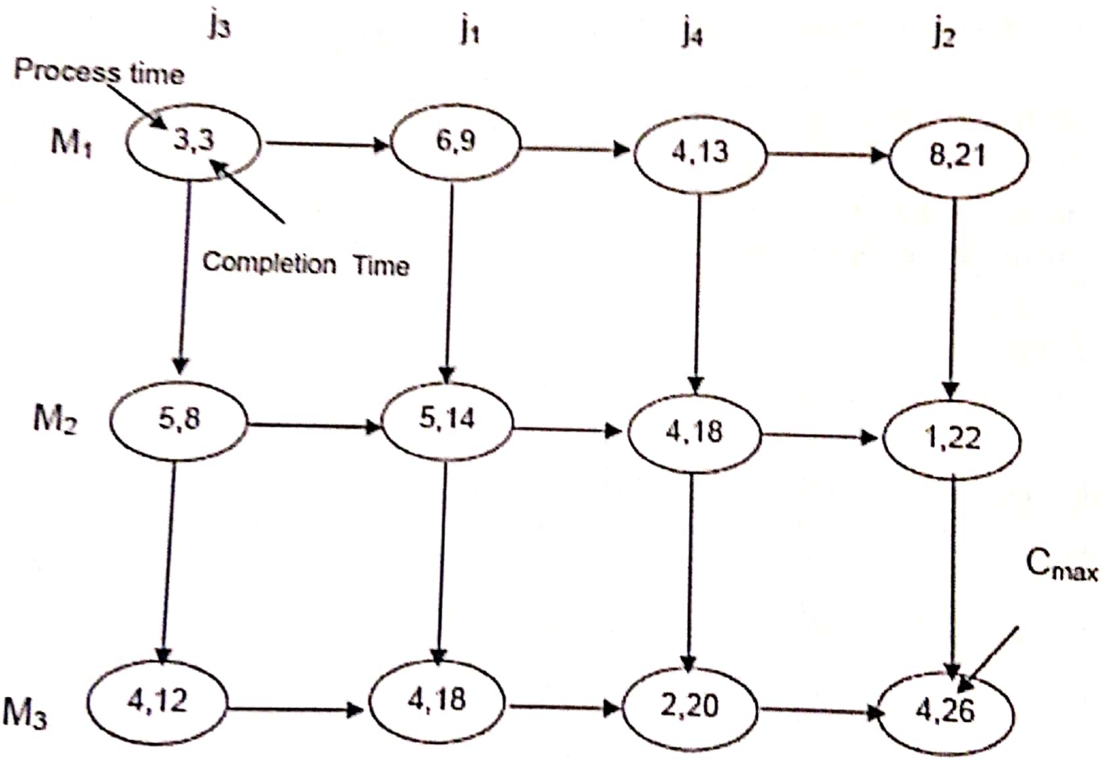

Figure 4.8 Directed graph for schedule {j3, j1, j4, j2}

Conclusion: Minimum C_{max} value is 26 using sequence: {j3, j1, j4, j2}

4.6.3 Nawaz, Enscor, and Ham (NEH) Algorithm

Nawaz, Enscor and Ham (NEH) algorithm constructs jobs sequence in iterative manner. Two jobs having largest values of total process times (called total work content) are arranged in a partial sequence one by one. The partial sequence having small value of C_{max} is selected for subsequent iteration. Then, next job from the work content list is picked. This job is alternately placed at all possible locations