

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Dept. of Industrial Engg & Management

MID-Term Examination 2013 (Spring)

Sub: Intelligent Manufacturing (IM60038)

Total Marks-50

Time-2 hours

.....Assume suitable data wherever be necessary.

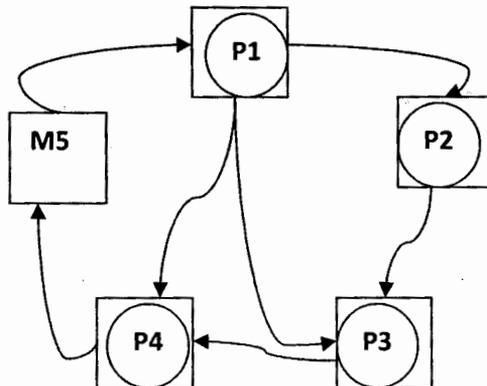
Question.1

Define CA_x and explain the current CA_x manufacturing chain with the help of a neat sketch?
How the interoperability can be achieved in CA_x network? **(10M)**

Question. 2

a. In most of the manufacturing systems the common phenomenon which affects the systems performance is deadlock. Define deadlock and its characteristics; explain how this deadlock affects manufacturing system and its performance? **(5M)**

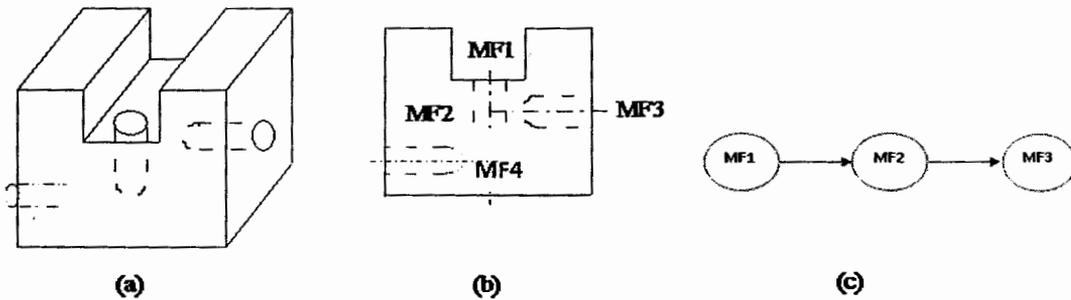
b. In the System, there are five machines and four jobs, which are under processed .The arcs shows the process direction. Show that system has Deadlock or not? **(5M)**



Question. 3

A manufacturing part portrayed in Figure 2 consists of four machining features such as one slot MF1, and three holes MF2, MF3 and MF4 and it is shown in Fig 2b. These features are produced with the precedence constraints and it is shown in Fig. 2c. The alternative machining processes for the individual machining features such as drilling, planning, milling based on the specifications of the machining features such as the machining tool, fixtures, and cutting tool are shown in the Table 1.

- Explain the detailed step wise procedure of AND/OR graph for the given manufacturing part? (3M)
- With the given information, generate the AND/OR graph for the manufacturing part and find the optimal manufacturing processing time for a part? Assume: Initial part value as 20 (7M)



Machine Feature ID (Numbers)	Machining Process ID (Processing time)	Machine Tool ID	Fixture ID	Cutting Tool ID
MF1 (10)	MP2 (20)	Mt1	Fi 1	Ct 1
MF2 (5)	MP4 (7)	Mt2	Fi 2	Ct 2
MF3 (5)	MP6 (10)	Mt1	Fi 1	Ct 1
MF4 (5)	MP8 (8)	Mt3	Fi 3	Ct 2
MF1 (10)	MP5 (6)	Mt1	Fi 1	Ct 1
MF2 (5)	MP7 (5)	Mt2	Fi 2	Ct 2

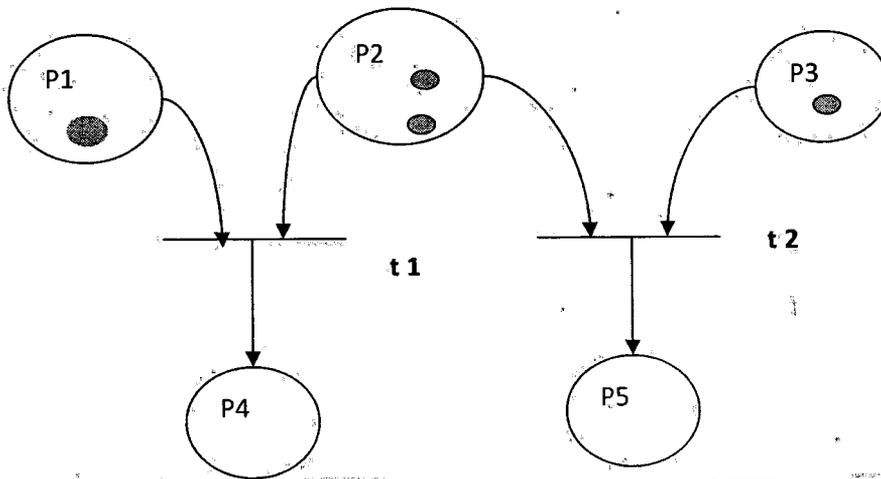
Table 1 alternative machining process for machining features MF1, MF2, MF3 and MF4

mt1 vertical machining center,
mt2 horizontal machining center,
mt3 horizontal machining center,

cf1 end-milling,
cf2 drill.

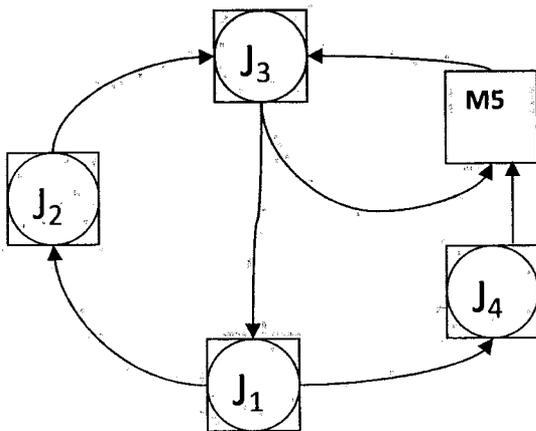
Question. 4

Define Petrinet and its functions with the help of an example. Find the Reachability graph for the given Petrinet. (10M)



Question. 5

The jobs have been processed on machines with different processing capabilities shown in the below circuit. Find the system deadlock and suggest the possible path to avoid the system deadlock



(10M)