每題配分：20 分

1. A clinic requires different numbers of full-time nurses on different days of the week (see below table). According to the new laws, each employee must work five consecutive days and then receive two days off. For example, a nurse who works Monday to Friday must be off on Saturday and Sunday. The clinic wants to minimize the number of nurses that must be hired when daily requirements for nurses are met.

	Minimum no. of nurses required
Monday	17
Tuesday	13
Wednesday	15
Thursday	19
Friday	14
Saturday	16
Sunday	11

(1) Model this problem (DO NOT solve).
(2) List appropriate assumptions of the modeling method you consider to apply.

2. A job shop has four machine and four jobs to be completed. Each machine must be assigned to complete one job. The time required to set up each machine for completing each job is shown in below table. The manager wants to minimize the total setup time needed to complete the four jobs.

	Setup time (hours)			
	Job 1	Job 2	Job 3	Job 4
Machine 1	14	5	8	7
Machine 2	2	12	6	5
Machine 3	7	8	3	9
Machine 4	2	4	6	10

(1) Model this problem with Linear Programming.
(2) Solve with the Hungarian Method.

3. A company is about to introduce a new product (Product X). One unit of Product X is produced by assembling 1 unit of Part M and 1 unit of Part N. Before production begins on either Part M or Part N, raw materials must be purchased and workers must be trained. Before Parts M and N can be assembled into Product X, the finished Part N must be inspected. A list of activities and their predecessors and of the duration of each activity is given in below table. As the manager, how long would you expect to complete the work?

Activity	Predecessors	Duration (days)
A = train workers	-	6
B = purchase raw materials	-	9
C = produce Part M	A, B	8
D = produce Part N	A, B	7
E = test Part N	D	10
F = assemble Parts M and N	C, E	12

4. Given
D = annual demand for product X　　C = purchase cost/per unit　　Q = economic order quantity
S = cost of placing an order　　　　L = lead time of an order　　H = annual holding cost/per unit of average inventory
Formulate the "total annual cost (including annual purchase cost, annual ordering cost, and annual holding cost)" with defined notations.

5. The weather service of Chungli City has determined the following transition probabilities for air pollution movement:

Day n	Day $n+1$		
	Clean	Average	Polluted
Clean	.3	.6	.1
Average	.3	.5	.2
Polluted	.1	.7	.2

(1) Determine the steady-state probabilities for each pollution state ($\pi = \pi P$).
(2) During a year, how many days will the air be in polluted state.