1. (18%) Given the notation below and the data in the following Table, answer the following questions.

t = a time period

D_t = demand in period t (in units)

c_t = unit production cost, not counting setup or inventory costs (dollars per unit) in period t

A_t : setup (order) cost to produce (purchase) a lot in period t (in dollars)

h_t : holding cost to carry a unit of inventory from period t to period $t+1$ (in dollars per unit per period)

t	1	2	3	4	5	6	7	8	9	10
D_t	20	50	10	50	50	10	20	40	20	30
c_t	10	10	10	10	10	10	10	10	10	10
A_t	100	100	100	100	100	100	100	100	100	100
h_t	1	1	1	1	1	1	1	1	1	1

(a) What is Wagner-Whitin Property?

(b) Use the Wagner-Whitin procedure to solve the dynamic lot-sizing decision for the above problem.

2. (18%) Given the following definitions and bill of materials (BOM), answer the following questions. In the BOM, the number inside a parenthesis is the required number of parts. Assume that leadtimes are 1 week for Stool and Base and 2 weeks for Legs.

Scheduled receipt (*Sched receipts*): the status of outstanding orders (both purchased and manufacturing)

Projected inventory (*Proj inventory*): (Scheduled receipt − Gross requirements + on-hand inventory)

Net requirements (*Net reqs*): the requirements when the projected inventory is less than zero
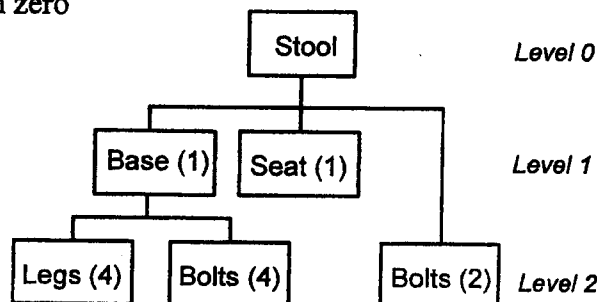
(a) What is low-level code? Why do we need it for MRP (material requirement planning) calculation?

(b) Use the following table format and basic data to solve the MRP problem. You need to fill in the following table for Stool. You will need two additional tables for Base and Legs.

（背面仍有題目,請繼續作答）

Item: Stool (Leadtime = 1 week)

Week	0	1	2	3	4	5	6
Gross Reqs						120	
Sched Receipts							
Proj Inventory	20						
Net Reqs							
Planned Orders							

3. (18%) Given the notation below, formulate the aggregate planning problem as a linear programming formulation to maximize the net profit while satisfying the necessary constraints. You need to provide proper explanations for the formulation to get full credit.

t = an index of the time periods, $t = 1, \ldots, \bar{t}$.

d_t = demand in period t.

c_t = capacity in period t.

r = unit profit (not including holding cost)

h = cost to hold one unit of inventory for one period.

X_t = quantity produced during period t.

S_t = quantity sold during period t.

I_t = inventory at the end of period t.

4. (12%) An $n = 10$, $c = 2$ acceptance sampling plan is being considered; assume that $p_0 = .05$ and $p_1 = .20$.

(a) Compute both producer's and consumer's risk for this acceptance sampling plan.

(b) Would the producer, the consumer, or both be unhappy with the proposed sampling plan?

(c) What change in the sampling plan, if any, would you recommend?

5. (18%) Over several weeks of normal, or in-control, operation, 20 samples of 150 packages each of synthetic-gut tennis strings were tested for breaking strength. A total of 141 packages of the 3000 tested failed to conform to the manufacturer's specifications.

(a) What is an estimate of the process proportion defective when the system is in control?

(b) Compute the upper and lower control limits for a p chart.

(c) With the results of part (b), what conclusion should be made about the process if tests on a new sample of 150 packages find 12 defective? Do there appear to be assignable causes in this situation?

(d) Compute the upper and lower control limits for an np chart.

(e) Answer part (c) using the results of part (d).

(f) Which control chart would be preferred in this situation? Explain.

6. (16%) Answer the following questions from the Lean production or Toyota Production System (TPS). You need to explain clearly or to provide a conceptual schema to get full credit.

(a) What is a two-bin pull system?

(b) What is 5S?

(c) What is Heijunka?

(d) What is 3M (Muda, Mura, Muri)?