系所組別： 製造資訊與系統研究所乙組

考試科目： 生產管理

考試日期：0220，節次：2

※ 考生請注意：本試題 □可 ☑不可 使用計算機

一. [26%] 有關精實生產(Lean Production)/TPS(Toyota Production System)，回答下列問題，每小題 3 分，第(8)小題 5 分。

(1) 舉例說明 Takt Time 的定義。

(2) 舉例說明平準化生產的定義。

(3) 舉例說明生產看板及領料看板的運作。

(4) TPS 為何有人機分離的想法及做法?

(5) 標準化的目的何在?

(6) 小生產批量的作法會造成換線頻繁的損失，為何還要這樣做?

(7) 舉三個事蹟來說明大野耐一對 TPS 的貢獻。

(8) 以 TPS House 說明 TPS 如何達成其卓越的生產績效。

二. [24%] 有關供應鏈管理(Supply Chain Management)，回答下列問題，每小題 4 分。

(1) 說明第三方物流(Third-party logistics)的定義並舉出其優缺點各 1 項。

(2) 說明供應鏈管理管理的長鞭效應現象如何發生。

(3) 說明存貨管理的風險共擔(Risk pooling)的原理及做法。

(4) 說明 VMI(Vendor Managed Inventory) 的做法。

(5) 說明越庫作業(Cross docking)的運作。

(6) 說明供應鏈整合時的推式-拉式策略之運作。

(背面仍有題目,請繼續作答)

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三、 [40%] Harvey Co. is a company that makes gardening tools. Assume they already give you their forecasted demands D_t for each week $t = 1, 2, .., T$, where $T \geq 10$. In order to satisfy all the demands at all periods with minimum total cost that includes the production costs and labor costs, you have to decide the optimal values for the following variables:

W_t : number of working employees in week t
H_t : number of hired employees in week t
L_t : number of employees to be laid off (i.e. fired) in week t
P_t : number of units produced in week t
I_t : inventory at the end of week t
S_t : number of units stocked out/backlogged at the end of week t
C_t : number of units subcontracted in week t
O_t : number of overtime hours by ALL employees in week t (Note: this is an accumulative value, NOT an individual overtime duration)

For the workforce management, an employee has to work 8hrs a day, 5 days a week regularly with α dollars every regular working hour. An employee may also work overtime besides his regular working hour with β dollars every overtime working hour. By labor regulation, the accumulative weekly overtime O_t for a company can NOT exceed $\widetilde{O}$ hours. In the beginning of each week t, you have to decide to hire H_t new employees, lay off L_t old employees, so that you have totally W_t employees work in that week. Hiring a new employee costs h dollars, and laying off an old employee costs f dollars.
For the production planning, in each week t, the company may produce P_t units of products with unit cost $\widehat{p}$ dollars or subcontract C_t units to be made by other manufacturers with unit cost $\widehat{c}$ dollars, based on the inventory I_{t-1} with unit cost $\widehat{i}$ dollars or stockout S_{t-1} with unit cost $\widehat{s}$ dollars in previous week, to satisfy the forecasted demand D_t.Assume each product can be made with θ labor hour (i.e. every θ hours, one unit of product can be produced).

Assuming $W_0 = 50$, $I_0 = 100$ and $I_T \geq 500$, answer the following questions regarding the aggregate planning formulation:
(1) [5%] Assuming D_t, α, β, $\widetilde{O}$, $\widehat{p}$, $\widehat{c}$, $\widehat{i}$, $\widehat{s}$, and θ are given parameters, is any of them a decision variable? Explain your answer.
(2) [5%] How much does it cost for one employee who works regularly in a week?
(3) [5%] How much does it cost for all the regular working hours in week t?
(4) [5%] How much does it cost for all the overtime working hours in week t?
(5) [5%] How many units can Harvey Co. produce at most by their own workforce in week t ?
(6) [5%] What is the value of S_0, explain your answer. Also, write down the constraints that restrict the relations between P_3, I_2, C_2, I_3, C_3 and D_3 for week 3.
(7) [5%] Write down the constraints that restrict the relations between W_5, W_4, H_5, and L_5 for week 5. Also, write down the relation between O_t and W_t that obeys the labor regulation.
(8) [5%] John is an undergraduate student who just took courses of Operations Management and Operations Research. He thinks $\widehat{p}P_t$, the cost to produce P_t units, and $\frac{8}{\theta}$, the maximum number of products produced by an employee without overtime, are both nonlinear. Therefore, he thinks this is a nonlinear programming problem. Do you agree or disagree? Explain your answer.

四、 [10%] Suppose a warehouse has to send out one truck to ship products to n retailers $r_1, r_2, ..., r_n$. The truck will visit each retailer exactly once, and return to the warehouse until all the retailers are visited. Suppose c_{ij} represents the distance between retailer i and j are given, and assume $c_{ij} = c_{ji}$.
(1) [2%] How many possible routes can this truck travel?
(2) [8%] If you are to solve for a route that has the shortest traveling distance for this truck, how do you model it as an integer programming problem?