94 學年度 工業工程與工程管理學系 乙組、丁組（一般生） 碩士班入學考試

科目 生產管理 科目代碼 2002、2202 共 3 頁第 1 頁 *請在試卷【答案卷】內作答

不得使用計算器

1. (20%)某一管理顧問公司每次完成一件專案時必須先向公司內的三位人士簡報審核：副總經理(A)、專案部經理(B)與專案副理(C)等。假設現在為 4/1 早上八點，共有五件專案在今天必須向總經理呈報簽核。由於每件專案內容、複雜度與重要性都不同，因此每件專案向副總經理、專案部經理與專案副理報告的時間也就不同，且因為專案性質或時間緊迫，專案未必都需向三位報告。當然不論副總經理、專案部經理與專案副理每次只能處理一件專案，且不能中途中斷正在進行處理中的專案。下表為五件專案的審核處理程序及今日最後需呈報總經理的截止時間，舉例來說，專案 2 需先由專案副理(C)處理 3 小時、再由專案部經理(B)處理 4 小時，然後向總經理呈報的最後期限是今日(4/1) 19 時前。

假設專案小組對於這五件專案的排程原則是以所謂「Event-based Scheduling」(提示:審核人員為主的排程方式)，且審核人員配合最短審核處理時間(SPT)法則的策略。試完成下列問題:

(1a)請以甘特圖繪出專案的審核作業排程，並指出在該排程下各專案完成時間點。

(1b)計算五件專案的平均流程時間(mean flow time)及無法來得及給總經理簽核的專案件數與編號。

專案編號	向總經理呈報的最後期限	副總經理(A)、專案部經理(B)與專案副理(C) 處理程序
1	4/1 20 時	A(3 hrs) → B(2 hrs) → C(2 hrs)
2	4/1 19 時	C(2 hrs) → B(4 hrs)
3	4/1 18 時	C(3 hrs) → B(2 hrs)
4	4/1 17 時	B(2 hrs) → C(1 hrs) → A(3 hrs)
5	4/1 21 時	B(3 hrs) → A(2 hrs) → C(3 hrs)

2. (20%)清華工具機製造商生產某一生產設備。目前已知庫存 30 座，其需求預測與目前所承接的顧客訂單資料如下所示(時間單位為週)。

	前期	1	2	3	4	5	6
需求預測		**25**	**25**	**25**	**25**	**25**	**25**
顧客訂單		**10**	**8**	**30**	**10**	**10**	**0**
預計庫存							
MPS							
ATP							

(2a) 請你依批量生產法為 40 座來規畫你的主生產排程(MPS)，並完成上表(預計庫存與 MPS 欄)。

(2b) 依你所訂之主生產排程，計算可承諾量(ATP, Available To Promise)於上表 ATP 欄，並解釋所引用之計算原理與各週數量之意義。

3. (10%) A production schedule problem for a paper mill: The input to a paper mill is wood fiber and pulp; the output is finished rolls of paper. The hearts of the paper mill is its a paper machine, which is very large and represent a significant capital investment. Assume the demand rate is d units per week, the production rate is p units per week, the inventory holding cost is h per unit per week, and the setup cost is s per setup. What is the EMQ formula for this problem? Please prove your formula.

4. (25%) Consider a factory that produces and sells two product types (product A and product B). One unit of these two products consumes the same amount of capacity and the capacity of the factory is 50 units of products per week. The inventory cost and backorder costs for product A are 2 dollars per unit per week and 4 dollars per unit per week, respectively. They are 1.5 dollar and 3 dollars for product B. The initial inventory levels are 10 units for product A and 20 units for product B. The demands for these products in the next 5 weeks are shown in the following tables:

product A:

	Week					
	0	1	2	3	4	5
Demands during the week		30	10	40	50	0
Production during the week						
Inventory level at the end of week	10					
Backorder level at the end of week						

product B:

	Week					
	0	1	2	3	4	5
Demands during the week		40	30	20	50	0
Production during the week						
Inventory level at the end of week	20					
Backorder level at the end of week						

(4a) (15%) Please determine the optimal production plans that minimize the total cost (the sum of inventory and backorder costs). Show your answers by filling out the above two tables. What is the minimal total cost?

(4b) (10%) Can this problem formulated as a transportation problem? Can this problem formulated as an assignment problem? Why?

5. (25%) Consider a single machine scheduling problem with n jobs available at time zero.

Assume the following notations:

i: the index for job.

p_i : the processing time of job i.

d_i : the due date of job i.

C_i : the completion of job i under a certain schedule.

L_i : the lateness of job i under a certain schedule.

T_i : the tardiness of job i under a certain schedule.

(5a) (5%) write the definition of L_i and T_i.

(5b) (5%) What is the dispatching rule that will minimize the maximum lateness?

(5c) (5%) Now, assume each job has an identical processing time of 1 unit time. That is, $p_i = 1, \forall i$.

Please write a binary integer program that will minimize the total tardiness of the problem.

The following hints will help you answer this question:

(i) There are n positions in the schedule, since there are n jobs to be assigned.

(ii) assume k as the index for position on a schedule.

(iii) assume the binary integer variable y_{ik} and $y_{ik} = \begin{cases} 1, \text{if job } i \text{ is assigned to position } k \\ 0, \text{otherwise} \end{cases}$

(iv) each position can only be occupied by one job.

(5d) (5%) Please write a binary integer program that will minimize the maximum lateness.

(5e) (5%) Please write a binary integer program that will minimize the total tardiness.