國立成功大學 107 學年度碩士班招生考試試題

系　　所：製造資訊與系統研究所

考試科目：生產管理

考試日期：0205，節次：2

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

***Questions* [40%]**

Please answer the following questions and justify your answer.

1. **[22%]** Operations Scheduling: (a) Describe the definitions of the sequencing rules including first-come first-served (FCFS), shortest processing time (SPT), earliest due date (EDD) and critical ratio (CR). (b) Show a comparison of pros and cons among these four sequencing rules. (c) What are the applicable conditions (or necessary conditions) of these four rules when you want to apply them in practice? (d) What are the performance metrics suggested to evaluate the sequencing rules?

2. **[18%]** Production System: (a) What is Little's Law? (b) What's bottleneck and how to define it? (c) What's the relationship between bottleneck and Little's law? (d) Do you have any idea to release bottleneck and improve the throughput? (e) How the Little's Law relate to the inventory control? (f) Is Little's Law always true in the shop-floor level? Why?

***Numerical Problem and Analysis* [60%]**

Please answer the following numerical questions and show all your work in detail.

3. **[20%]** Capacity Planning Problem

NCKU company produces the ceramic cup and develops the production plan that minimizes total costs using part-time worker. Each worker can produce 200 cups per week on regular time. Instead of paying undertime, the employee's working time can be adjusted: working time is shortened during slack weeks and overtime can be used during peak weeks. Now, 10 workers are employed. Constraints and cost information are as follows.

- The size of training facilities limits the number of new hires in any period to no more than 5.
- Backorders are permitted.
- Overtime cannot exceed 20 percent of the regular-time capacity in any week. The most that any worker can produce 1.2*200=240 cups per week.
- Regular production cost: $5 per cup
- Overtime production cost: $10 per cup
- Inventory holding cost: $1 per cup-week
- Hires: $1,000 per person
- Layoffs: $2,000 per person

The forecasted demand is shown as follows.

	Week1	Week2	Week3	Week4	Week5	Total
Forecasted demand	1600	2200	2800	2400	2000	11000

(a) **[*7%*]** Use the chase strategy (zero inventory plan) to build the cost table

(b) **[*7%*]** Use the level strategy to build the cost table

(c) **[*3%*]** Show pros, cons, and applicable condition between chase strategy and level strategy

(d) **[*3%*]** In this case, which one is better? Why?

4. **[*14%*]** Lot-sizing Scheme

NCKU machine shop schedule production lot sizes for cell phone assembly. The holding cost is $2 per phone per week, and the production setup cost is $100. The next five weeks demands are shown as follows.

	Week1	Week2	Week3	Week4	Week5
Forecasted demand	1600	2200	2800	2400	2000

(a) **[*7%*]** Use the Silver-Meal heuristic to solve the lot-sizing problem.

(b) **[*7%*]** Use the Least Unit Cost heuristic to solve the lot-sizing problem.

5. **[*18%*]** Queueing Theory

NCKU hot-pot restaurant provide 24-hour service with the identical meal to customers. The customers enter the restaurant following the Poisson process with an average inter-arrival time 15 minutes. Each customer only orders one meal. The restaurant provides the meal at the average of 6 meals per hour with a service time following exponential distribution. The queueing line is infinite.

(a) **[*3%*]** What's the probability of the empty restaurant?

(b) **[*3%*]** What's the average number of customers in queue (waiting for service)?

(c) **[*3%*]** What's the average waiting time of each customer in queue (waiting for service)?

(d) **[*3%*]** A customer will leave if waiting for 5 minutes, what's the minimal service rate you suggest to drive productivity?

(e) **[*3%*]** Now, the restaurant would like to propose a new design which divides the single server into two sub-servers with the half of the original service rate and still maintaining single queueing line. Do you think this is a good idea? Why?

(f) **[*3%*]** Now, the restaurant would like to propose a new design which divides the single server into two sub-servers with the half of the original service rate and form two sub-queueing lines. Do you think this is a good idea? Why?

6. **[8%]** Quality Assurance

NCKU factory installed a computer vision system to measure the length of a screw, from cap to tip. The computer vision systems has achieved a resolution of 0.001mm when measuring a screw of 3mm long. For a couple of engineering reasons, a screw of a length between 3mm±0.01mm is considered acceptable, otherwise he screw is rejected as a defect. The system is tested using a sample of 100 randomly selected screws. The result is extremely encouraging. NCKU's system correctly accepts every good screw while rejecting every defective screw. Therefore, NCKU claims that her system is error-free in this application. However, Professor Picky disagrees and points out that under the assumption of normally distributed inspection errors, he can easily hand pick (not randomly at all) a set of screw lengths such that theoretically NCKU's inspection system will be expected to make an average of 50% error.

(a) **[4%]** Describe how the set of screw lengths Professor Picky will hand pick.

(b) **[4%]** Explain why NCKU's inspection system is expected to make an average of 50% error for such as set of hand-pick test specimens.