1.(20%)

(1) Complete the following MRP record. Lead time is two weeks, and lot size is 100.
Initial MRP

| Week | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Gross requirements | | 70 | 40 | 80 | 50 | 40 |
| Scheduled receipts | | 100 | | | | |
| Projected on hand | 50 | | | | | |
| Net requirements | | | | | | |
| Planned order receipts | | | | | | |
| Planned order releases | | | | | | |

(2) During the week, the following events occur. Enter them in the MRP record. (Please explain the calculation process)

a. The planned order for 100 in week 1 is released.
b. Thirty of the scheduled receipts for week 1 are scrapped.
c. Another order(or requirement) for 20 is received and added for delivery in week 3.
d. An order(or requirement) for 40 is received for delivery in week 6.
e. The gross requirements of 70 in week 1 are issued.

| Week | | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Gross requirements | | | | | | |
| Scheduled receipts | | | | | | |
| Projected on hand | | | | | | |
| Net requirements | | | | | | |
| Planned order receipts | | | | | | |
| Planned order releases | | | | | | |

2.(25%)清華糕餅公司銷售一頗受歡迎之酥餅，其產品定位策略為存貨式生產(MTS)，且每天計劃性生產總數量(產能)上限為 1000 盒。在進行主排程(Master Scheduling)時，規劃時程(Time Horizon)設為一周，而規劃時格(Time Bucket)則設為天。其中預測資料為老闆根據過去經驗所收集彙總，客戶訂單則表示已接受的訂量且需如期交貨，ATP(Available-to-Promise)為可承諾數。假設現在時間為 3/31，正進行主生產排程(Master Production Schedule, MPS)，現有存貨有 200 盒。每天生產批量為 500 盒之倍數生產，最高 1000 盒。生產排程的規則為當有存貨時，不作任何生產，但當預計存貨降為零以下即排生產，不考慮安全庫存。

(1) 請完成下表之預計存貨與生產量(MPS)。

| 天 | | 4/1 | 4/2 | 4/3 | 4/4 | 4/5 | 4/6 | 4/7 |
|---|---|---|---|---|---|---|---|---|
| 預測 | | 700 | 800 | 900 | 900 | 800 | 800 | 800 |
| 客戶訂單(orders) | | 600 | 600 | 700 | 600 | | | |
| 預計存貨(Projected available) | 200 | | | | | | | |
| 生產量(MPS) | | | | | | | | |
| 可承諾數(ATP) | | | | | | | | |

(2) 請完成上表之 ATP，並說明其計算方法與 ATP 之意義。

(3) 3/31 經主管核定上述排定的主生產排程後，到 4/1 清晨接到下列客戶 A,B,C(依來到順序)訂單及其交期，在不變動前小題(1)既排定的 MPS 生產量計畫下，請問如何利用 (2)之 ATP 資訊回答可否接單？又希望每筆訂單均可承接，你/妳將如何協調來分配訂

單? 請說明你/妳的決策理由。

| 訂單 | 數量 | 交貨時間 |
|------|------|----------|
| 客戶 A | 600 | 4/2 |
| 客戶 B | 300 | 4/5 |
| 客戶 C | 300 | 4/3 |

3. (10%) A semiconductor wafer fabrication facility has an average WIP level of 450 lots and an average production rate of 12500 wafers per month. Each lot contains an average of 25 wafers. How do you estimate the average production lead time (or cycle time) for this factory and what is your estimation?

4. (15%) The following table contains information related to the major activities of a research project.

| activity | precedes | Expected time (days) |
|----------|----------|----------------------|
| a | - | 4 |
| b | - | 9 |
| c | b | 5 |
| d | a | 2 |
| e | a | 6 |
| f | d, c | 3 |

(1) draw a precedence diagram.

(2) compute the slack for each activity.

(3) determine the critical path.

5. (15%) A manufacturer makes a certain product at a rate of $p$ units per day. Also, the setup cost is $s$ dollars for each run of the production. The demand rate for this product is $d$ units per day and its inventory holding cost is $h$ dollars per unit per day. Assume the product rate is greater than the demand rate.

(a) What is the EMQ (economic manufacturing quantity) that will minimize total cost? Please clearly show the steps you take to derive your answer.

(b) Now, suppose that the warehouse space can only store up to $I$ units of the products. What is the EMQ under such a constraint?

6. (15%) Consider a company that designs, produces, and sells swimsuits. About six months before summer, the company must commit itself to specific production quantities for its product. Since there is no clear indication of how the market will respond to the new designs, the company uses various forecast tools to predict demand, and plan production and supply accordingly. The trade-offs are clear: overestimating customer demand will result in unsold inventory while underestimating will lead to inventory stockouts and loss of potential customers. To assist management in these decisions, the marketing department use market research method, historical data from the last five years, and current economic conditions to construct a probabilistic forecast of the demand of swimsuits. They identify several possible scenarios for sales in the coming season and assign each a probability, or a chance of occurring. These scenarios are illustrated in the following figure.
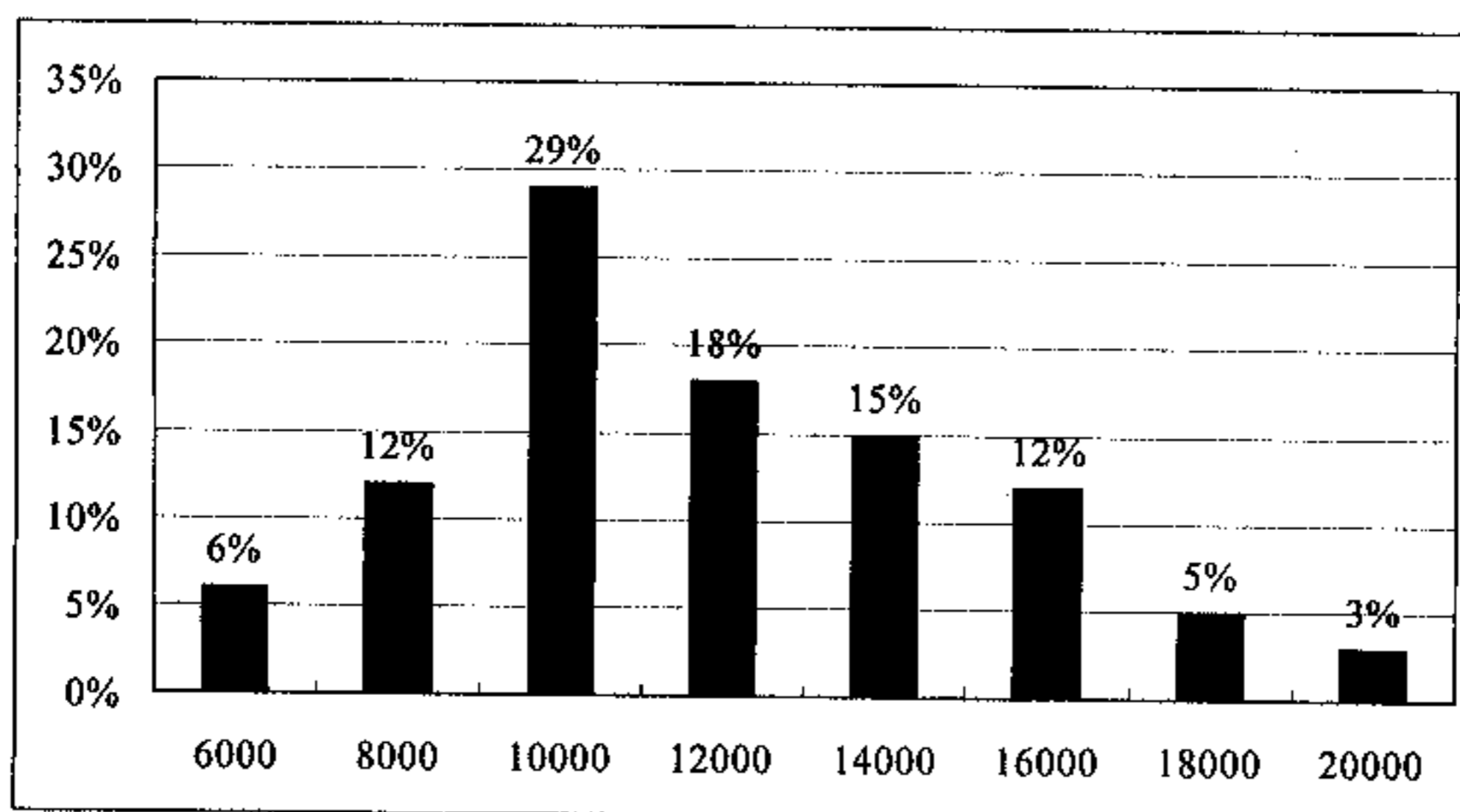


For example, the marketing department believes that a scenario that leads to 6,000 unit sales has 6 percent chance of happening. To start production, the manufacturer has to invest $80,000 independent of the amount produced. In addition, the variable production cost per unit equals $85. During the summer season, the selling price of a swimsuit is $125 per unit. However, any swimsuit not sold during the summer season is sold to a discount store for $75.

(1) How do you calculate the expected demand?

(2) What is the optimal quantity of swimsuit that the manufacturers should produce in order to maximize the expected profit?

(3) Should the optimal production quantity be equal to, more than, or less than the expected demand?