**CM 3450**
**Assignment 2**
**Due: 9/19/2008, 5pm**

1. A stream containing compounds $a$, $b$, $c$, $d$ and $e$ are fed to a series of distillation columns as shown in Figure 1 with corresponding stream compositions given in Table 1.

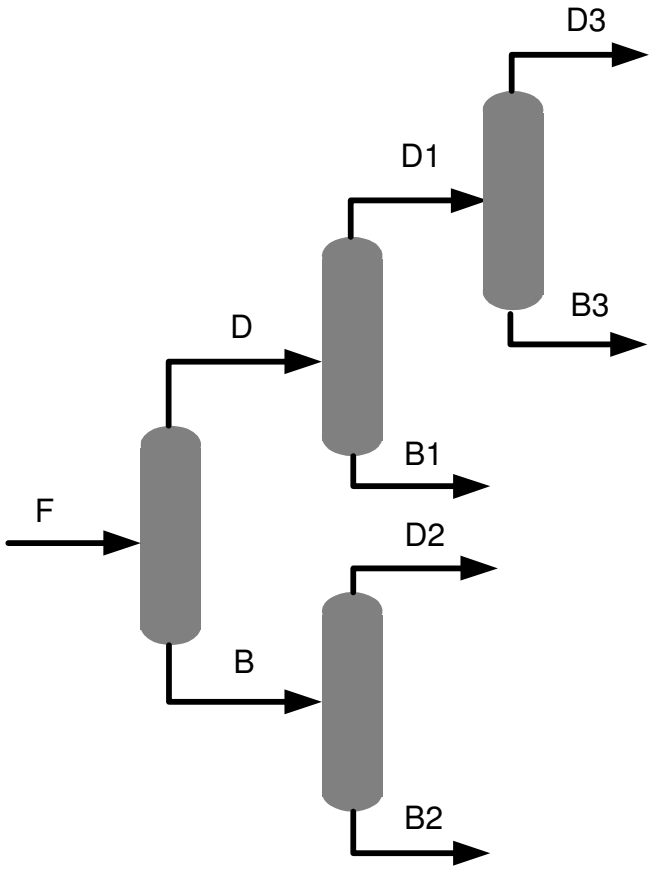


Figure 1. Distillation Train.

Table 1. Stream compositions.

| Stream | Composition of Compounds ( mol per cent ) | | | | |
|---|---|---|---|---|---|
| | *a* | *B* | *c* | *d* | *e* |
| F | 20 | 22 | 20 | 20 | 18 |
| D3 | 80 | 5 | 4 | 4 | 7 |
| B3 | 10 | 50 | 30 | 5 | 5 |
| B1 | 15 | 15 | 10 | 30 | 30 |
| D2 | 20 | 10 | 40 | 30 | 0 |
| B2 | 3 | 7 | 10 | 20 | 60 |

**Problem:** Determine the molar feed flow rate $F$ and the mixture compositions in $D$ such that the flow rate of $D3 = 20$ kmol/min.

2. Given six types of crude oil with products of the following composition:

| | Gasoline | Heating Oil | Jet Fuel | Lube Oil |
|---|---|---|---|---|
| Crude 1 | 55% | 22% | 15% | 6% |
| Crude 2 | 60% | 15% | 20% | 2% |
| Crude 3 | 40% | 30% | 25% | 0% |
| Crude 4 | 40% | 35% | 20% | 0% |
| Crude 5 | 50% | 15% | 8% | 20% |
| Crude 6 | 44% | 20% | 10% | 22% |
| | | | | |
| Price | $160/bbl | $160/bbl | $120/bbl | $100/bbl |
| Max Weekly Demand | 165,000 bbl | 100,000 | 110,000 | 80,000 |

| | Cost ($/bbl) | Operating Cost ($/bbl) | Availability (bbl/week) |
|---|---|---|---|
| Crude 1 | 110 | 20 | 80,000 |
| Crude 2 | 110 | 17 | 100,000 |
| Crude 3 | 115 | 19 | 100,000 |
| Crude 4 | 120 | 15 | 95,000 |
| Crude 5 | 120 | 18 | 75,000 |
| Crude 6 | 115 | 17 | 110,000 |

**Problem:** Find the weekly processing of each crude to maximize profit per week.
(Hint: compared with the drill, you need to add one more set of constraints)