Optimisation Problems

→ Finding best solution

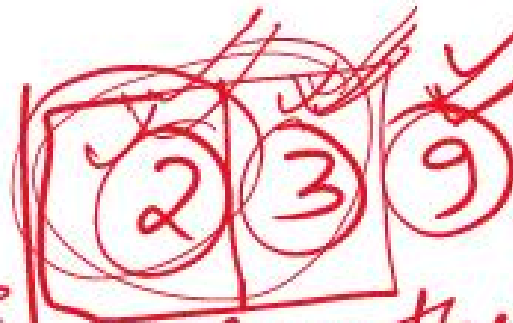
$Y = Eqn$

Least Y

Minima

$Y = Eqn \; q^x.$
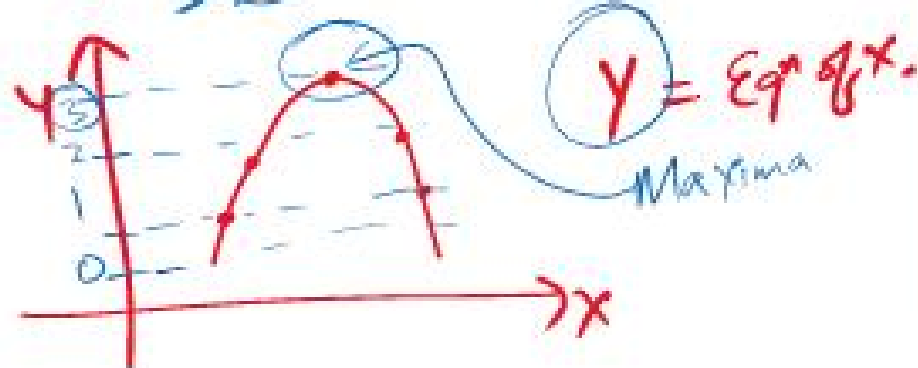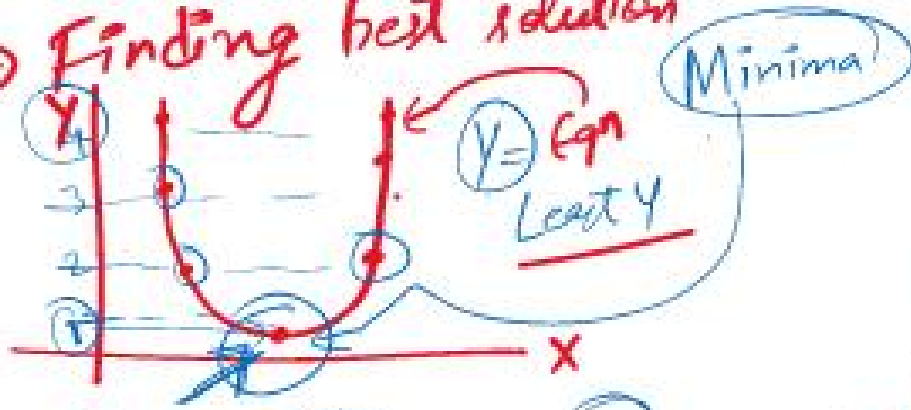
Maxima

Ways of Solving

1. Greedy Algo (Method)
2. Branch & Bound
3. Dynamic Programming

Min Y
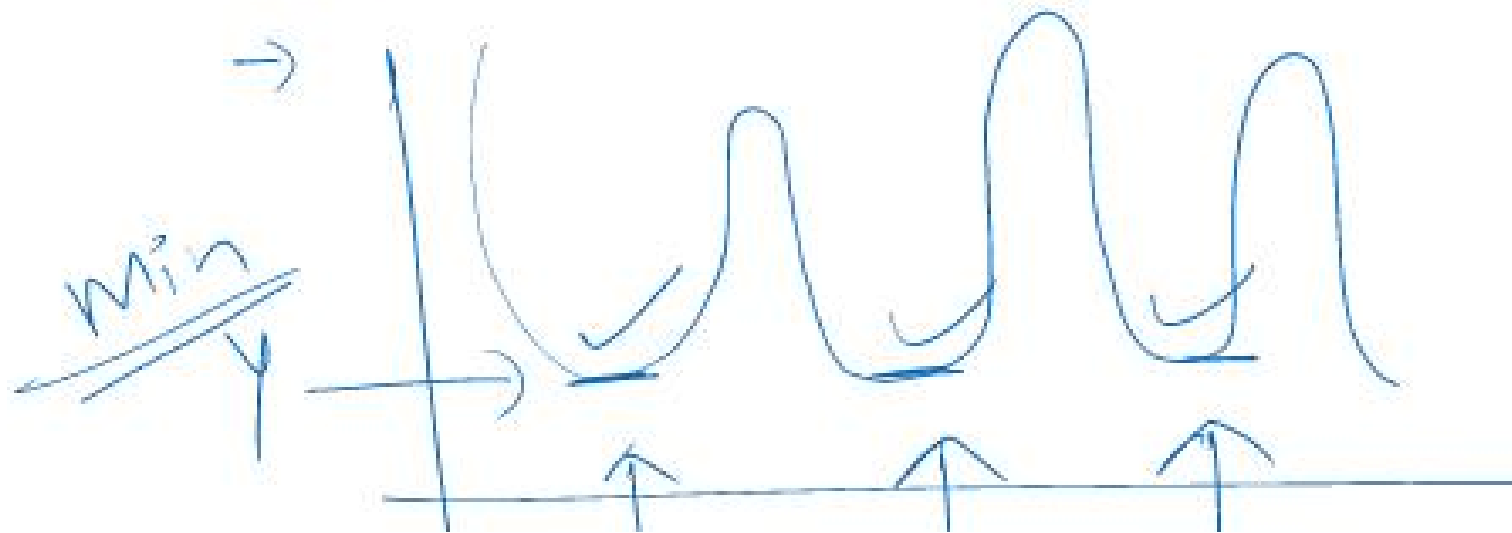
Greedy Strategy
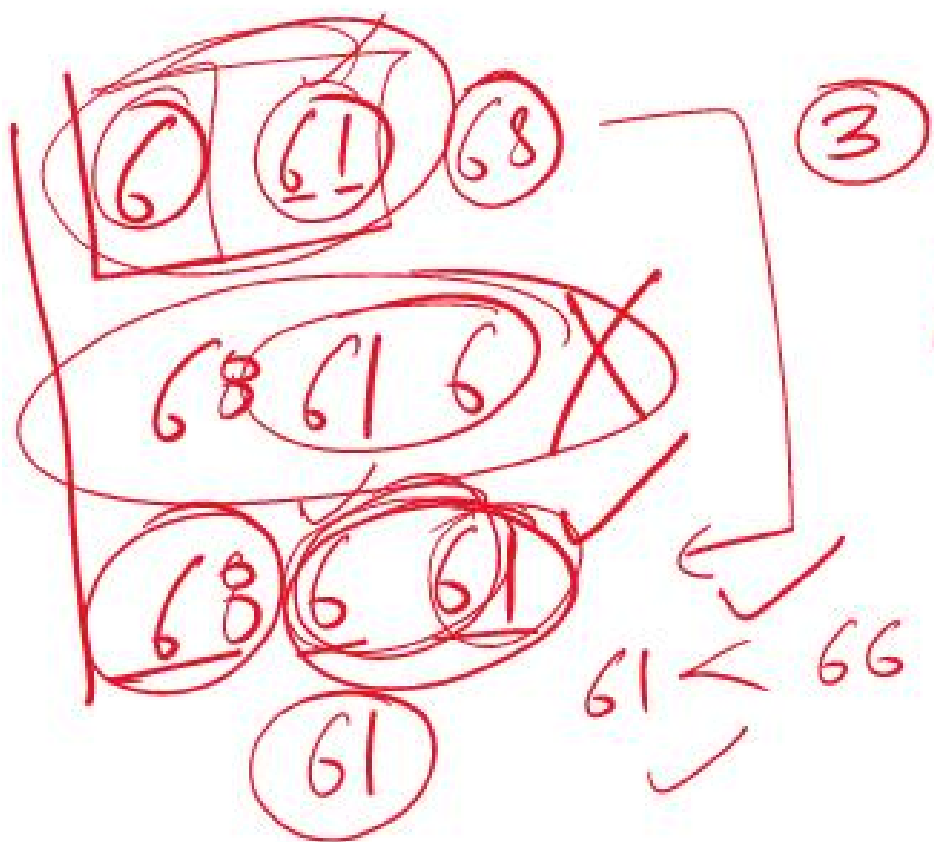
→ Make some greedy choice

⇒ Reduce to a smaller problem

→ Iterate ✓

Only Valid for single digits

Greedy: Selecting the largest digit
Choice

Maximy the Number

$$2 \quad 3 \quad 9$$

$$9 \quad 3 \quad 2$$

$6 < 61$

$6+1 = 7$

$\boxed{16} = 7$

Leftmost position should be the greatest one possible ✓

③

$61 < 66$

6 61 68

68 61 6

68 6 61

61
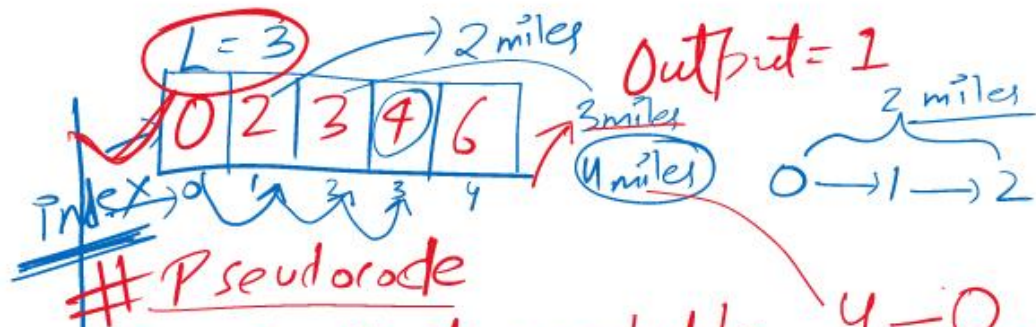
Greedy Choice
in Car Refuel

① ~~Refill at the closest gas station.~~

② Refill at the farthest reachable gas station

③ ~~Go until there is no fuel~~   [we may not found a fuel tank then]

L = 3   → 2 miles   Output = 1

| 0 | 2 | 3 | 4 | 6 |

Index → 0   1   2   3   4

3 miles
4 miles

2 miles
0 ──→ 1 ──→ 2

Pseudocode

Q1. Farthest reachable gas station?

4 − 0 ✓
= 4 ≤ ③

station mile − last-refill-mile ≤ mileage

x ↘   ↓   ↓↙

$A = x_0 \leq x_1 \leq x_2 \leq \cdots \leq x_n \leq x_{n+1} = B$ ✓

$x =$ | | 2 | 3 | |

Condition

$lastrefill = 0$

```
MinRefills(x, n, L) ✓
  numRefills = 0,  currentRefill = 0
  while (currentRefill < n):
    lastRefill = currentRefill
    while (currentRefill < n and
           x[currentRefill + 1] − x[lastRefill] ≤ L):
      currentRefill = currentRefill + 1
    if currentRefill == lastRefill:
      return IMPOSSIBLE
    if currentRefill ≤ n:
      numRefills = numRefills + 1
  return numRefills
```

$X = $ | 0 | 2 | 3 | 4 | 6 |

X contains the miles
where refill Pump
is present

$numRefills = 1$

$6 - 3 \leq 3$

$3 - 0 \leq 3$

$4 - 0 \leq 3$

$x = $ | 0 | 2 | 3 | 4 | 6 | ✓

$0 \to 0$

$x[0+1] - x[0] \leq 3$

$2 - 0 \leq 3$

$2 - 0$

$2 - 0 \leq 3$ = Number of miles
covered with my
Car.

3 miles

9:10

Fractional Knapsack

Sugar, Tea, Honey, Kiwi

objects = ① ② ③ ④ = 17kg

Weights = 2kg 3kg 5kg 7kg

Profits = 10 5 15 7 Rs

Maximum Profit

Capacity = 8kg

2kg 3kg 8k 7kg
10 5 13 7

One Occurence

15
8-5kg

15+10=25
26

3
3-2=1

Fractions ✓ Allowed

Gold Silver Diamond 50kg 3kg 5kg 2kg
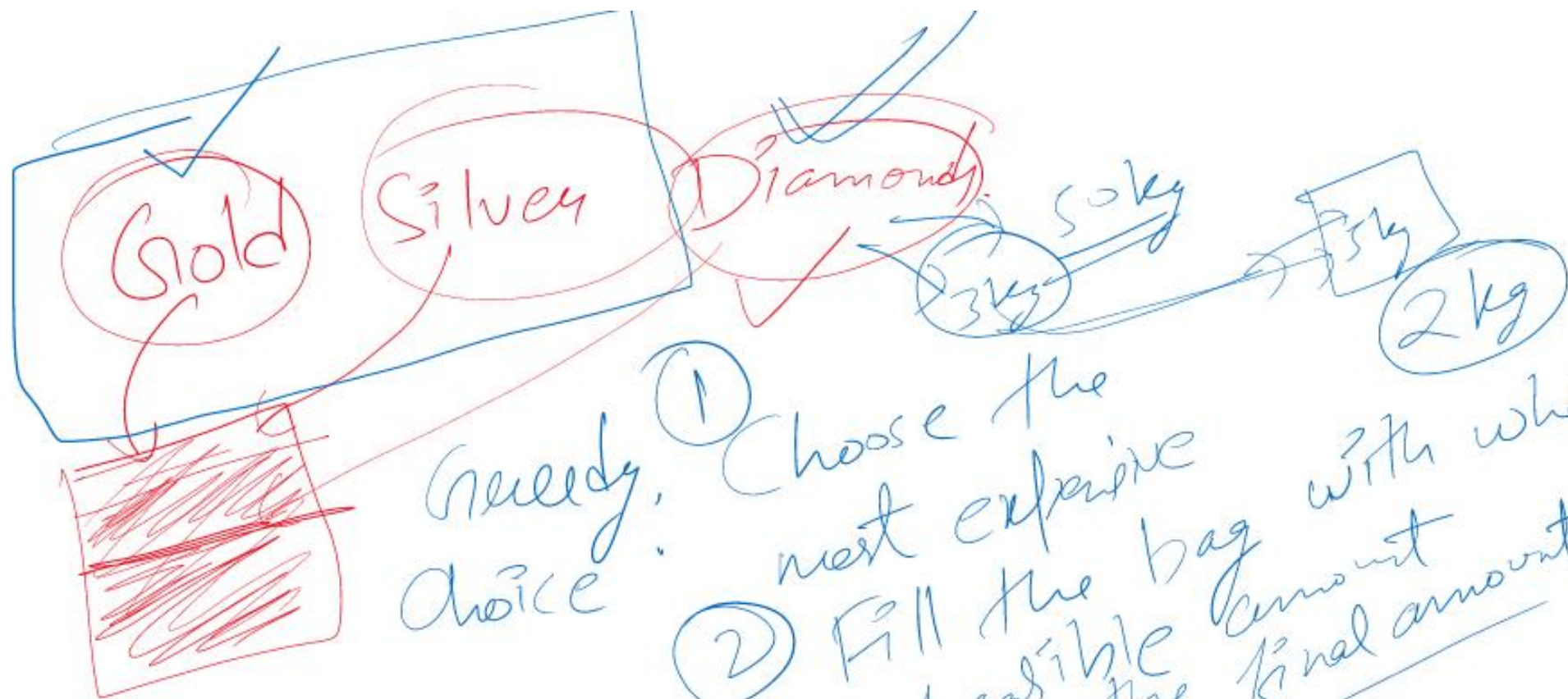
Greedy. ① Choose the most expensive choice.

② Fill the bag with whatever feasible amount

③ get the final amount left

④ Subproblem choose the nxt