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ASSIGNMENT #5

21K-3873
BSE-5A
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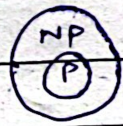
Question 01:-

a) P:- A deterministic approach to solve the problem in polynomial time.

NP:- A non deterministic approach to solve the problem in polynomial time.

P = NP means NP problem can belong to class P problem; means every problem whose solution is verified to be in polynomial time can also be solved in polynomial



b) If a problem is NP-complete, there is very likely no polynomial-time algorithm to find an optimal solution. The idea of approximation algorithm is to develop polynomial-time algorithms to find a near optimal solution.

c) A problem is strongly NP-Hard when all numbers in the input are bounded by some polynomial in the length of input, or we can say after finding solutions we are getting a non-polynomial time complexity, weakly NP-Hard means the problems that are not hard enough to lie in NP-Hard, means the time complexity is non-polynominal enough to not to lie in NP Hard or not enough to lie in Hard class problems.

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d) It is boolean satisfiability problem that determines the formula satisfies a given Boolean formula in form of Boolean Values, If it evaluates TRUE, it is satisfiable and if it does not, means it is not satisfiable.

e) NP complete problem means the problem is in non-deterministic polynomial time and any problem in NP can be reduceable to it.

To prove a problem is NP complete

1. Show the problem is in NP to verify its correctness
2. Select a known NP-complete problem
3. Reduce the known NP-complete problem to the new problem.

Example

$$3\ SAT \propto Vertex$$

reduces

f) Reduction is a technique to identify whether a known problem is as hard as the new problem or vice versa. Means if you can solve problem A in polynomial, you can also solve problem B in polynomial time

g) Since $T(n) = 2^n$; it will be categorized as NP-Hard due to too much answers and exponential value hard to define.

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Question : 02 -: AVC = Approx-vertex cover

- Assume a minimum vertex-cover is U'
- Vertex-cover produced by Approx-vertex-cover (G) is U
- The Edge chosen in AVC is A A
- The Vertex in U' can only cover one edge in A so $|U'| >= |A|$
- For each edge in A , there are 2 vertices in U so $|U| = 2|A|$
- so $|U'| \geq |U|/2$
- so $\frac{|U|}{|U'|} \leq 2$

Question : 03

Since all of words have no repeated letters, the first word selected will be that appears the earliest i.e 'thread', Now we see the words with the most non visitable word ; since 'lost' has four letters unvisited ; we select it , the next is 'drain' has two letter not covered after that only 'shun' is the one ~~un wanted~~ unvisited that give set of [thread, lost, drain, shun]

Question : 04

- JARVIS March
- Start with smallest y-cordinate
- Rotate sweep line around current point in ccw direction
- First point hit is on the hull
- Repeat

- Compute the angle between current point and all other remaining point using

$$\alpha = \tan^{-1}\frac{x}{y}$$

- pick the smallest angle larger than current angle
- $O(N)$ per iteration

According to this points will be
(-6, -10) -> (6, -6) -> (8, 0) -> (9, 5) -> (-8, 8) ->
(-10, 4) -> (-10, 3) -> (-8, -6)

- Graham Scan
- Choose a point with smallest y-cardinate
- Sort points by polar angle with p to get simple polygon
- Consider points in order, and discard those that would create a clockwise turn

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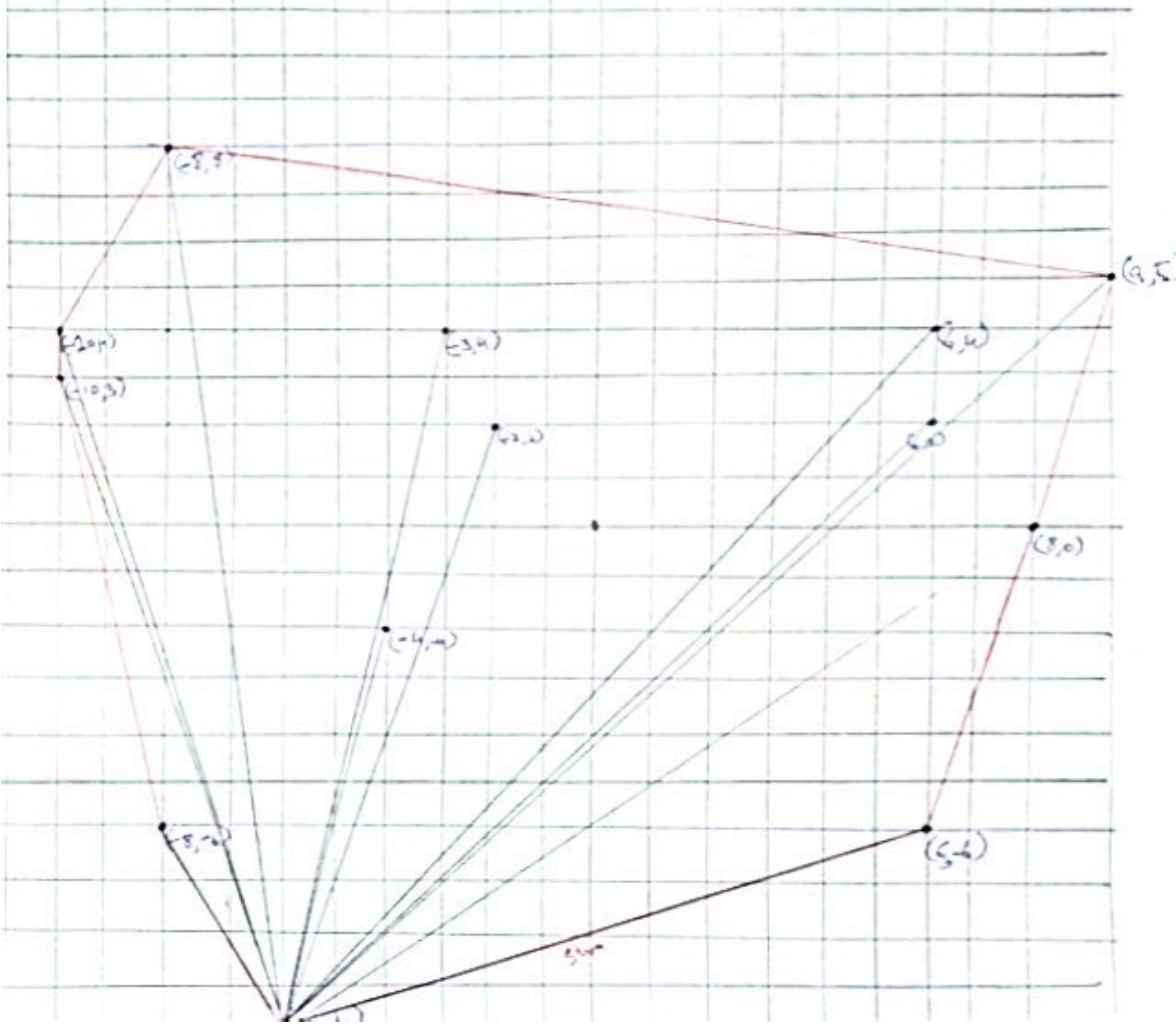
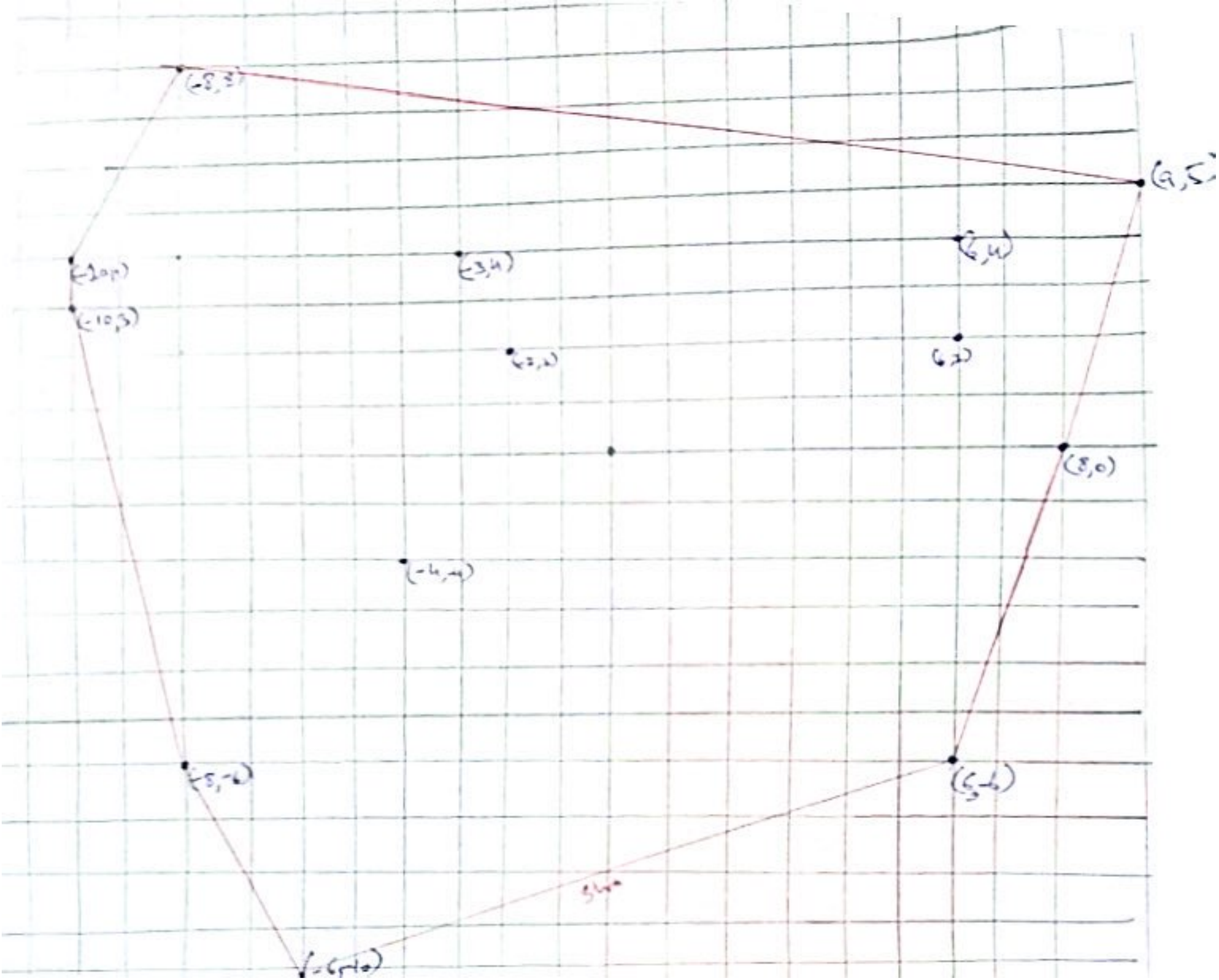
- point[0] = points[N]
int M = 2
for (int i = 3; i <= N; i++)
    while (Point.ccw(p[M-1], p[M], p[i]) <= 0) M--;
    M++
    swap (points, M, i)
}
```

so points are: (-6, -10) -> (6, -6) -> (8, 0) -> (9, 5
-> (6, 2) -> (6, 4) -> (-2, 2) -> (-4, 4) -> (-3, 4) -> (-8,
 -> (-10, 4) -> (-10, 3) -> (-8, -


(9,5
(-3,4)
(8,0)
(-4,-4)
(5,-6)


(9,5)
(6,4)
(-3,4)
(-10,3)
(8,0)