Design And Analysis Of Algorithms

Date: 2-12-22.

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K20-1052
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BSE-5B.

Assignment #5

Q.1

a) P problems can be solve in polynomial time by a deterministic algorithm while NP problems are verifiable in polynomial time if a correct polynomial solution is given. P=NP means that whether a NP problem can belong to P problem, if each solution is verifiable by a polynomial time algorithm that is solvable.

b) If a solution is NP complete, there is a chance that no optimal polynomial time solution exist. So it is better to find an approximation algorithm that can find near optimal solution.

c) NP hard problems can only be solved if and only if there is a NP complete problem that is verifiable in polynomial time. Weakly NP ~~complete~~ hard problems are NP complete problem that can be solved by a non-deterministic algorithm in polynomial time.

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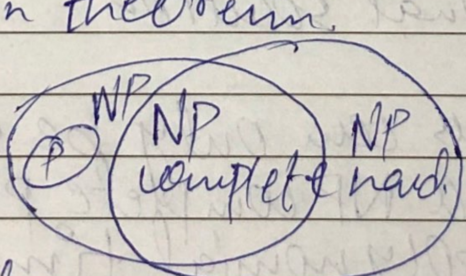
d) The 3 SAT is a Boolean satisfiability problem that requires a faster algorithm so that the formula can be given in Boolean Algebra, where the variables are not known even if solution is verifiable

e) NP complete problems belong to NP and every problem from NP polynomially reduces to it. In order to verify, first prove that the problem has a solution in polynomial time. Then choose a known NP complete problem, design an algorithm ~~f~~ that transforms the problem into verifiable form. Test the correctness of algorithm, proved that it runs in polynomial time. Example is 3 SAT that was a proven NP complete because its problem defination was in COOK-Levin theorem.



f) NP complete problems have some decision problem that no one knows how to solve, but if there exist a solution then every NP would be solvable in polynomial time. Therefore, reductions helps in deducing those soutions if A problem is solvable then B problem can be mapped using previous solution.

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g) It is a NP hard problem as it is validated in $T(n) = 2^n$ time.

Q.2. Approx-Vertex-Cover(G).

Consider that we have x minimum vertex-cover. So the approx-vertex-cover (G) would have x vertices that covers whole graph. Each edge chosen would be Y. The vertex in X can only cover 1 edge in A. Therefor $x \geq Y$. For every edge in V there are 2 vertices in x so $x = 2A$. And $x' >= x/2$ then $x/x' \leq 2$

Q.3 a b c d e f g h i j k l m n
o p q r s t u v w x y z

First ~~tett~~ word we would choose is 'thread', as it covers max letters. Now we will see the remaining letters and choose the words that covers remaining words. 'Lost' covers four dist letters that are not mentioned apart from t. The next one is drain as it covers two new letters. Last one is shun that covers remaining letters. Final set of word cover is {thread, lost, drain, shun}.

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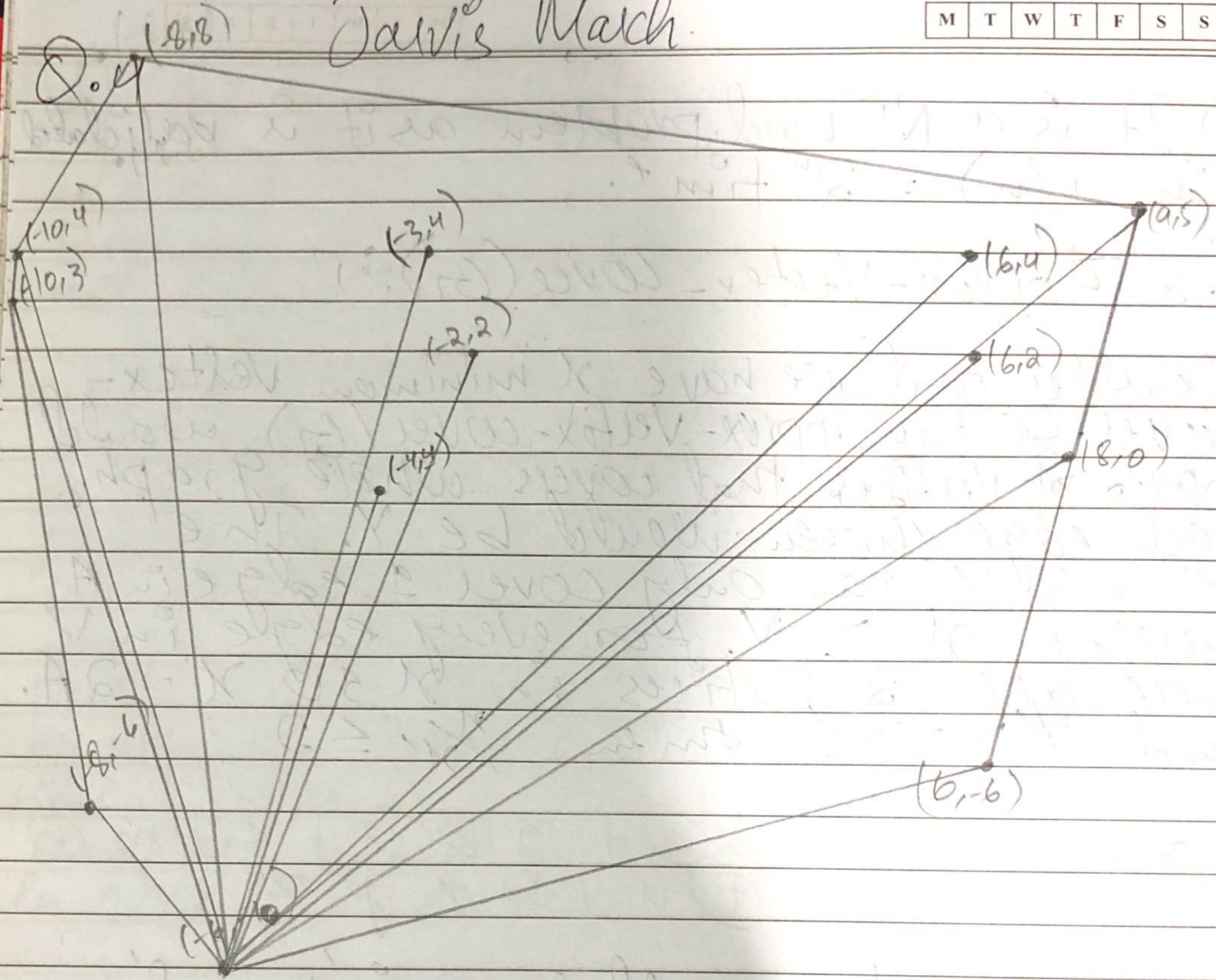
Q.4



- Starting with smallest point on y-axis that is (-6,-10)
- Rotate sweep line around that point in ccw direction.
- The first point hit is on the convex hull.
- Choose the angle b/w current point & remaining points and pick smallest angle larger than current

Points at convex hull (-6,-10), (8,0), (9,5), (-8,8), (-10,4), (10,3), (-8,-6), (6,-6)

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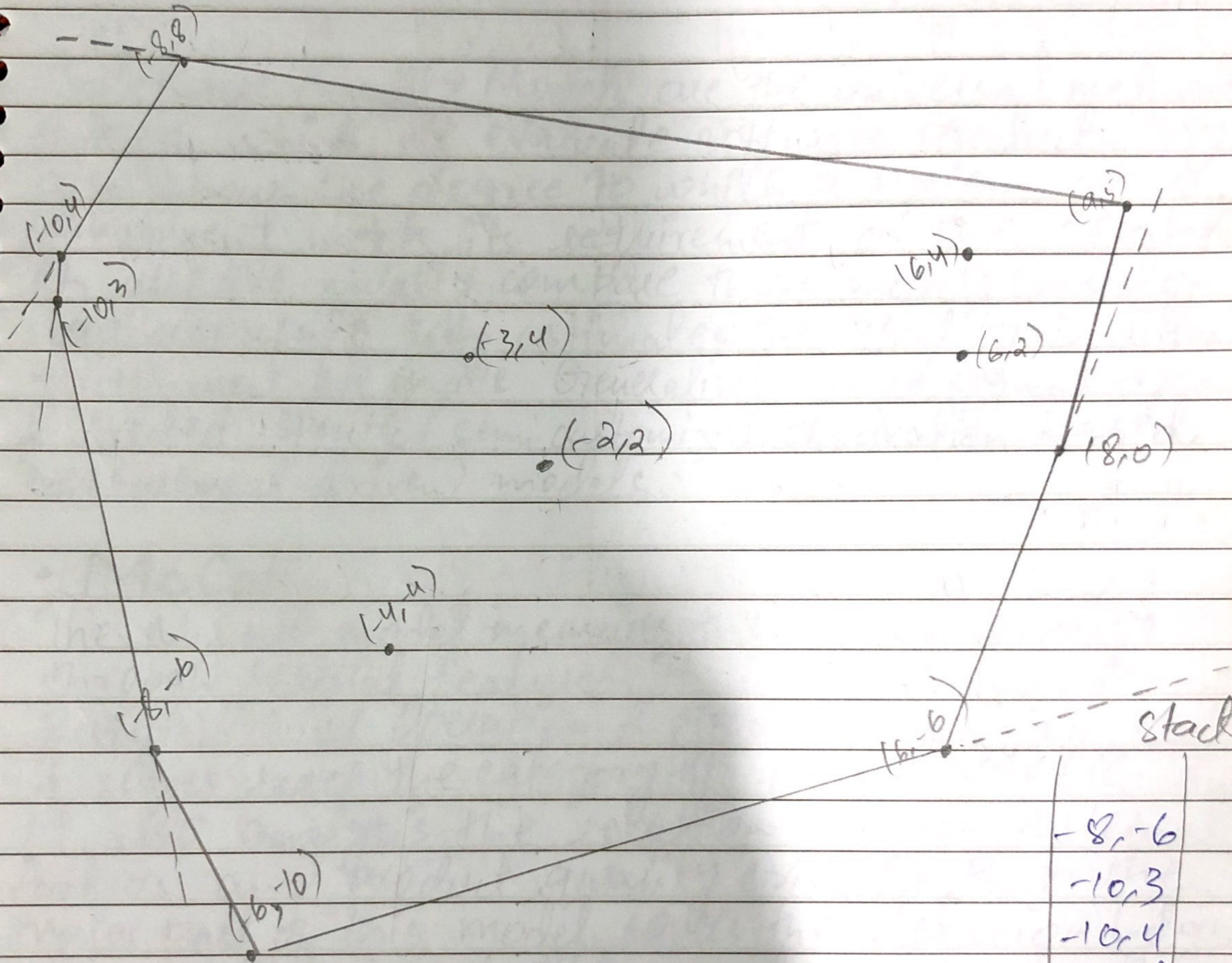
B) Graham Scan.



stack

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

Points already pop-ups from stack due to being on the right side of line are (6,2), (6,4) (-3,4) (-2,2) (-4,-4). Points in stack are part of convex hull.