COMPUTER SCIENCE

PAPER-2

ARTIFICIAL INTELLIGENCE

MAHA MARATHON

LIVE

SUBSCRIBE

DAILY 4-5PM | 7-8PM

By Rashmi Ma'am

Combine CS
The Extra Step

June 1st - 15th Schedule	Marathon Session + Practice Ques	
youTube Free Class	PAPER-1 Practice Ques.	PAPER-2 CS Practice Ques.
Way to JRF 2022	4:00 pm - 5:00 pm	7-8 pm
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Analysis

AI 2021 2022

Unit

Reduce

1. Probability – 5 (AI, easy)
2. Search Techniques – 2 Properties Based Ques (new, moderate)
3. FOPL -1 (PYQ)
4. Agent – 1 (PYQ)
5. Alpha Beta – 1 (FAQ) Min - Max

Total No. of Questions = 10

Search
Informed uninformed
blind
inf.

1

Breadth

Best-first BFS + DFS

1. Select the best from all the nodes encountered so far in OPEN.
2. "good" use heuristics (approx)

S — D

1000

2

90%

A*: Optimal search using heuristics

– Properties of A*

1. admissibility,
2. consistency,
3. accuracy and dominance
4. Optimal efficiency of A*

Complete

ML / DL

min cost

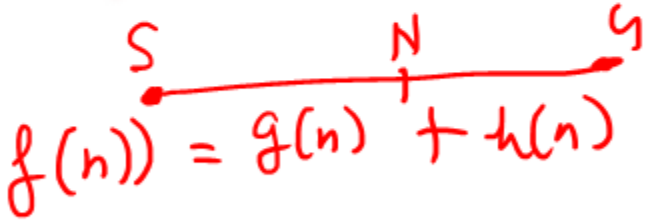
complete + optimal

AU

A* Search

- Idea:
  - avoid expanding paths that are already expensive
  - focus on paths that show promise
- Evaluation function f(n) = g(n) + h(n)
- g(n) = cost so far to reach n
- h(n) = estimated cost from n to goal
- f(n) = estimated total cost of path through n to goal

objective



(1) A* is Complete, why? A* always terminates with a solution path

(2)

Admissible A*

- The heuristic function h(n) is called admissible if h(n) is never larger than h*(n), namely h(n) is always less or equal to true cheapest cost from n to the goal.
- A* is admissible if it uses an admissible heuristic, and h(goal) = 0.
- If the heuristic function, h always underestimates the true cost

(h(n) is smaller than h*(n)), then A* is guaranteed to find an optimal solution.

148 2018

(3) **Consistent (monotone) Heuristics**

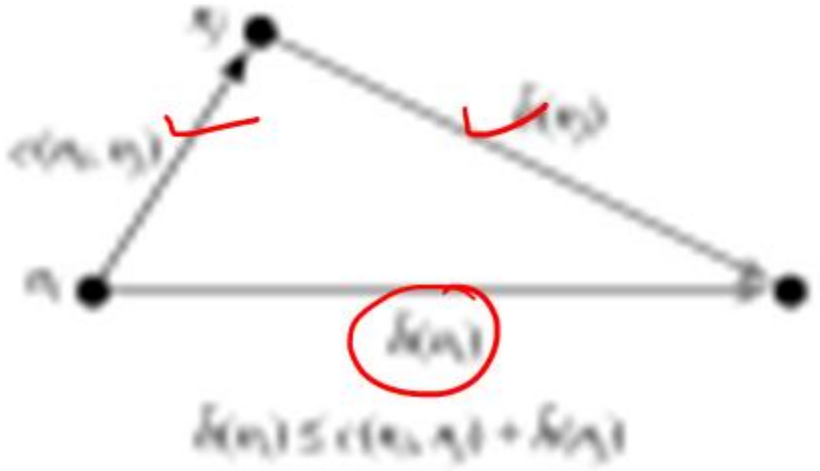
- **A heuristic is consistent if for every node n, every successor n' of n generated by any action a,**

$h(n) \leq c(n,a,n') + h(n')$

If h is consistent and h(goal)=0 then h is admissible

h is consistent if the heuristic function satisfies triangle inequality for every n and its child node n': h(ni) <= h(nj) + c(ni ,nj)

A*(admissible/consistent) will expand only nodes whose f-values are less (or equal) to the optimal cost path C* (f(n) is less-or-equal C*). The evaluation function of a goal node along an optimal path equals C*.



3k
3k

Summary

Complete?? Yes, unless there are infinitely many nodes with $f \leq f(G)$

Time?? Exponential in [relative error in h × length of soln.]

Space?? Keeps all nodes in memory drawback, Complexity

$O(b^d)$

Optimal?? Yes—cannot expand f_{i+1} until f_i is finished

PYQ
2018

S1: A* expands all nodes with $f(n) < C^*$ less

S2: A* expands some nodes with $f(n) = C^*$

S3: A* expands no nodes with $f(n) > C^*$ X

C* - optimal cost

f(n) - evaluation

A* 20 min ??

2019, 2020, 2021 Algorithm

Properties of Branch-and-Bound

- Not guaranteed to terminate unless
  - has depth-bound
  - admissible f and reasonable L
- Optimal:
  - finds an optimal solution (f is admissible)
- Time complexity: exponential
- Space complexity: can be linear
- Advantage:
  - anytime property
- Note : unlike A*, BnB may (will) expand nodes f>C*

* not complete

A* → exp. perform

③

DFS - infinite loop

Iterative Deepening A* (IDA*)
(combining Branch-and-Bound and A*)

- Initialize: f <-- the evaluation function of the start node
- until goal node is found
  - Loop:
    - Do Branch-and-bound with upper-bound L equal to current evaluation function f.
    - Increment evaluation function to next contour level
  - end
- Properties: Complete
  - Guarantee to find an optimal solution
  - time: exponential, like A*
  - space: linear, like B&B.
  - Problems: The number of iterations may be large

2017
2020
2022
4

new

AND/OR search spaces
– Decomposable independent problems
– Searching with non-deterministic actions (erratic vacuum)
– Using AND/OR search spaces; solution is a contingent plan
• Local search for optimization
– Greedy hill-climbing search, simulated annealing, local beam search, genetic algorithms.
– Local search in continuous spaces

expected

AND / OR GRAPHS
Nodes represent subproblems
– AND links represent subproblem decompositions
– OR links represent alternative solutions
– Start node is initial problem
– Terminal nodes are solved subproblems

Informed
Best First
A*
IDA*
AND-OR

Q1) DFS is _____ efficient and BFS is _____ efficient.

a) Space, Time
b) Time, Space
c) Time, Time
d) Space, Space

Q1) DFS is linear _____ efficient and BFS is _____ efficient.

a) Space, Time
b) Time, Space
c) Time, Time
d) Space, Space

Agent

Q2) When the environment of an agent is partially observable in search space following problem/problems could occur.

a) Sensor less problems: If the agent has no sensors at all, then (as far as it knows) it could be in one of several possible initial states, and each action might therefore lead to one of several possible successor states

b) Contingency problems: If the environment is partially observable or if actions are uncertain, then the agent's percepts provide new information after each action. Each possible percept defines a contingency that must be planned for. A problem is called adversarial if the uncertainty is caused by the actions of another agent

AND-OR

c) Exploration problems: When the states and actions of the environment are unknown, the agent must act to discover them. Exploration problems can be viewed as an extreme case of contingency problems

Informed

d) All of the mentioned

exam difficult

PYQ - AI

Q2) When the environment of an agent is partially observable in search space following problem/problems could occur.

a) Sensor less problems: If the agent has no sensors at all, then (as far as it knows) it could be in one of several possible initial states, and each action might therefore lead to one of several possible successor states

AND-OR

b) Contingency problems: If the environment is partially observable or if actions are uncertain, then the agent's percepts provide new information after each action. Each possible percept defines a contingency that must be planned for. A problem is called adversarial if the uncertainty is caused by the actions of another agent.

c) Exploration problems: When the states and actions of the environment are unknown, the agent must act to discover them. Exploration problems can be viewed as an extreme case of contingency problems

d) All of the mentioned

Best First

Q3) Optimality of BFS is _____

a) When there is less number of nodes
b) When all step costs are equal
c) When all step costs are unequal
d) None of the mentioned

Mock Test 2021

XX

Breadth first

Queue DS

Unequal

Best first

step cost

path

BFS

$f(n) = h(n)$

Consistent / Admissible

step cost min

Q3) Optimality of BFS is _____

Best Greedy, Recursive (promising)

a) When there is less number of nodes

b) When all step costs are equal ✓

c) When all step costs are unequal

d) None of the mentioned

Q4) Depth-first search always expands the _____ node in the current fringe of the search tree.

a) Shallowest
b) Child node
c) Deepest
d) Minimum cost

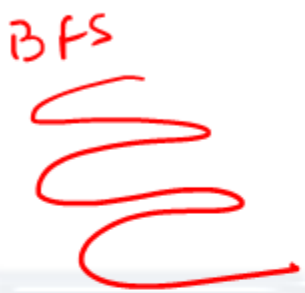
DFS

Q4) Depth-first search always expands the _____ node in the current fringe of the search tree.

a) Shallowest BFS - Breadth first
b) Child node
c) Deepest
d) Minimum cost (Uniform cost search

Q5) uniform-cost search expands the node n with the _____

a) Lowest path cost
b) Heuristic cost
c) Highest path cost
d) Average path cost



Q5) uniform-cost search expands the node n with the _____

a) Lowest path cost

b) Heuristic cost

c) Highest path cost

d) Average path cost

Uniform-cost search expands the node n with the lowest path cost. Note that if all step costs are equal, this is identical to breadth-first search.

ex!!

Q6) Breadth-first search is not optimal when all step costs are equal, because it always expands the shallowest unexpanded node.

a) True
b) False

BFS ∈ AI - optimal complete T=S=O(b^d)

2021 - step cost = (1)

Uniform = same

Uniform cost search ↳ min path cost

Step cost = 1 → BFS

Q6) Breadth-first search is not optimal when all step costs are equal, because it always expands the shallowest unexpanded node.

a) True

b) False

again

Breadth-first search is optimal when all step costs are equal, because it always expands the shallowest unexpanded node. If the solution exists in shallowest node no irrelevant nodes are expanded.

Strategies

Q7) Strategies that know whether one non-goal state is "more promising" than another are called _____

a) Informed & Uninformed Search
b) Uninformed Search
c) Heuristic & Uninformed Search
d) Informed & Heuristic Search

Strategies concept twist high learning.

certain

Q7) Strategies that know whether one non-goal state is "more promising" than another are called _____

a) Informed & Unformed Search
b) Unformed Search
c) Heuristic & Unformed Search
d) Informed & Heuristic Search

Summary

step cost

Q8: Given below are two statements

Statement I: Breadth-First Search is optimal when all the step costs are equal whereas uniform-cost search is optimal with any step-cost.

Statement II: When all the step costs are same uniform-cost search expends more nodes at depth d than the Breadth-First Search.

In light of the above statements, choose the correct answer from the options given below

A) Both Statement I and Statement II are false
B) Both Statement I and Statement II are true
C) Statement I is false but Statement II is true
D) Statement I is true but Statement II is false

Q8: Given below are two statements

Statement I: Breadth-First Search is optimal when all the step costs are equal whereas uniform-cost search is optimal with any step-cost.

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In light of the above statements, choose the correct answer from the options given below

A) Both Statement I and Statement II are false

B) Both Statement I and Statement II are true

C) Statement I is false but Statement II is true

D) Statement I is true but Statement II is false

True

eliminate

last

Q9: Which among the following statement(s) is(are) FALSE?

A. Greedy best-first search is not optimal but is often efficient.
B. A* is complete and optimal provided h(n) is admissible or consistent.
C. Recursive best-first search is efficient in terms of time complexity but poor in terms of space complexity.
D. h(n) = 0 is an admissible heuristic for the 8-puzzle

A) A and D only
B) A only
C) C and D only
D) C only

Q9: Which among the following statement(s) is(are) FALSE?

A. Greedy best-first search is not optimal but is often efficient.

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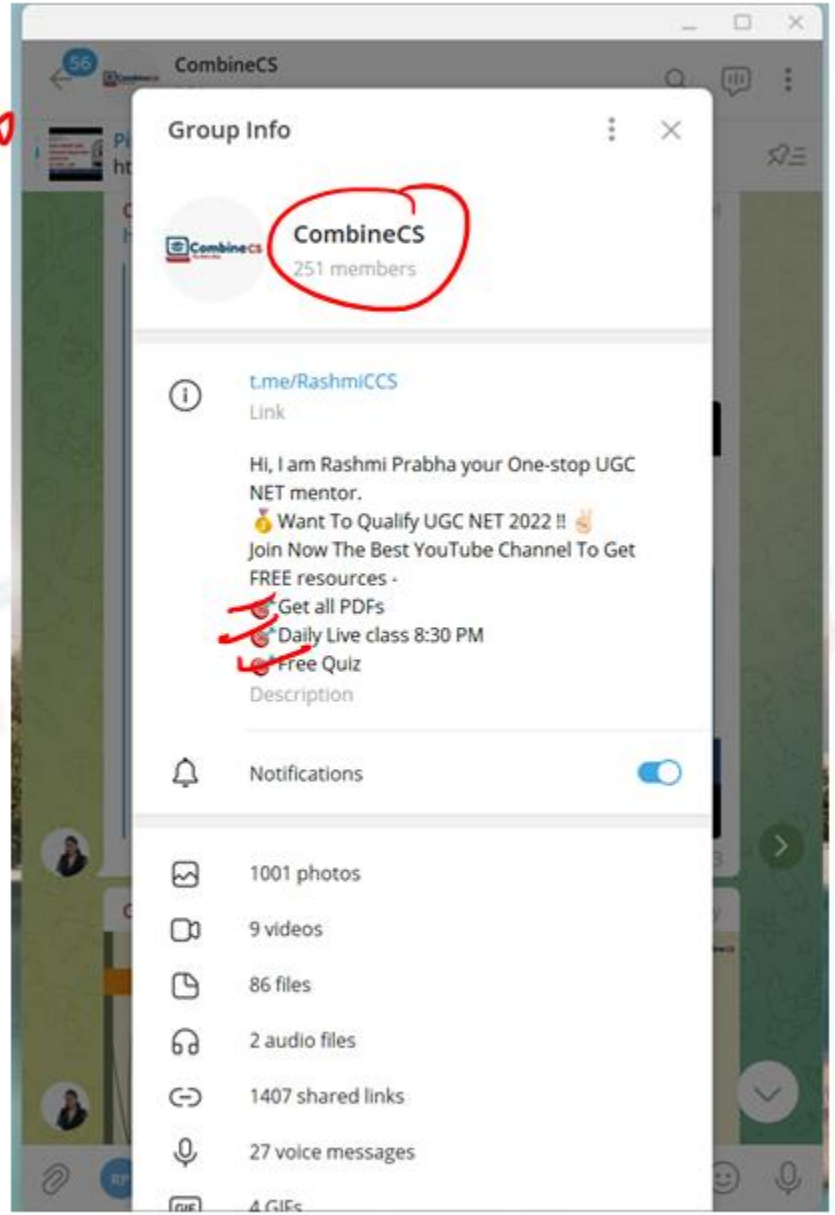

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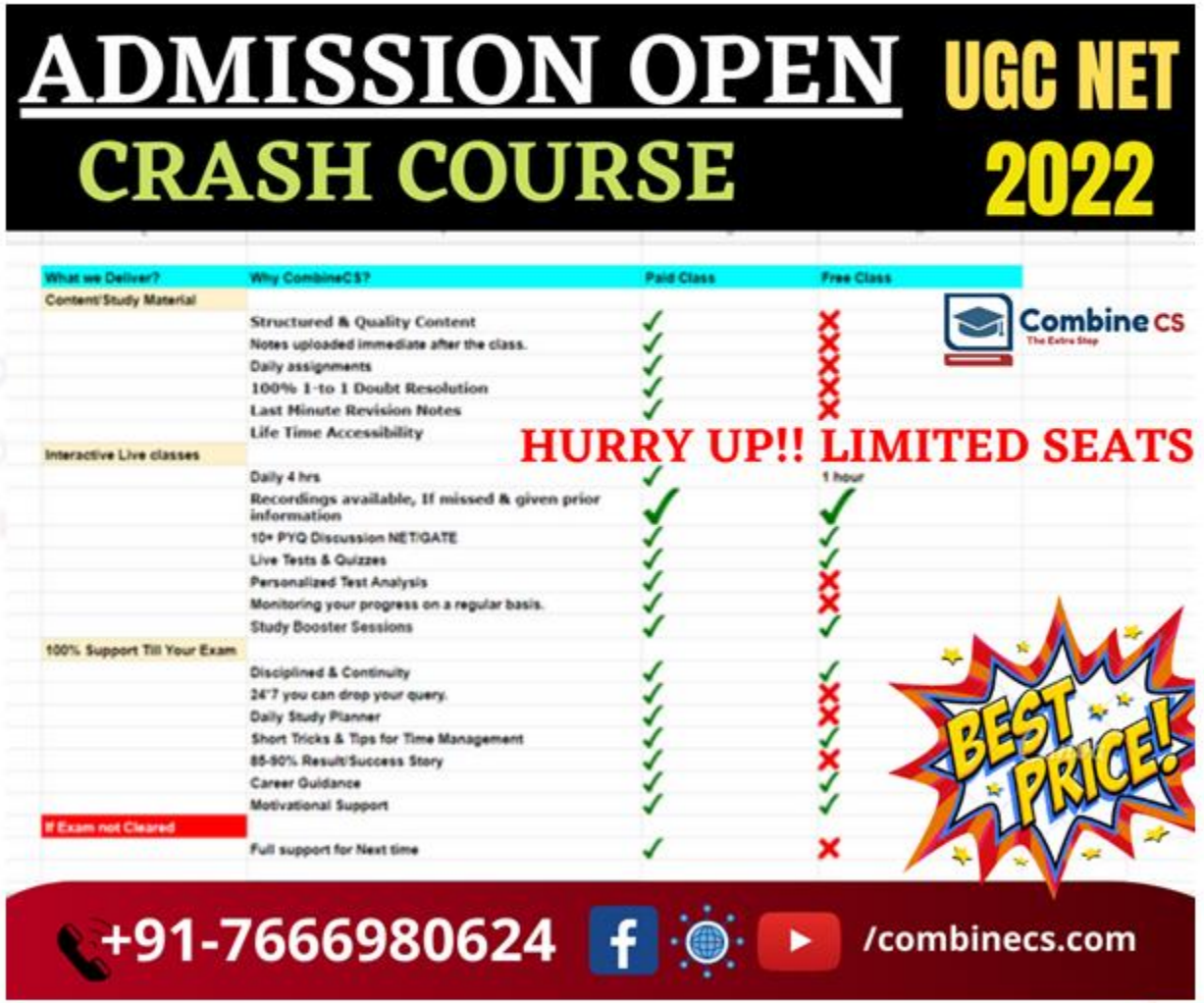

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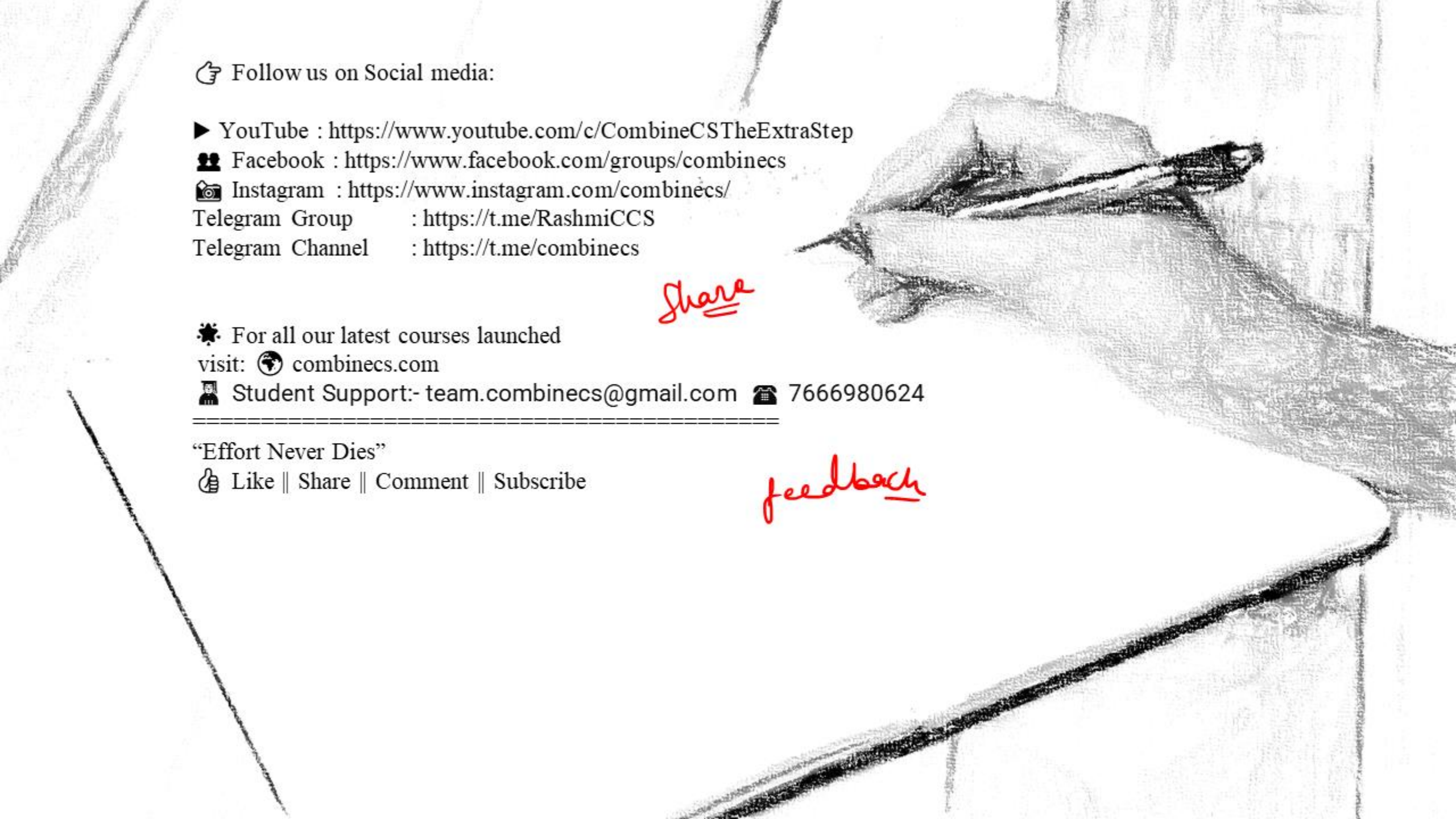

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