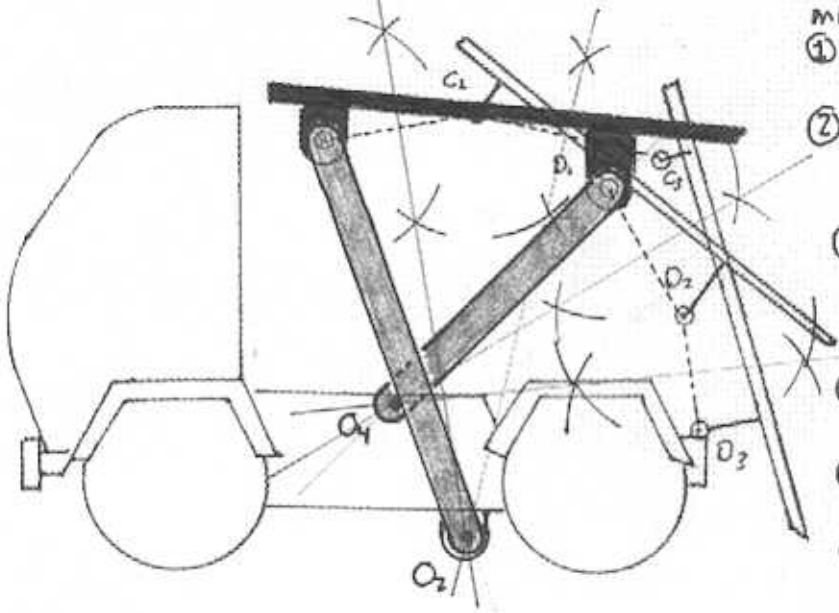
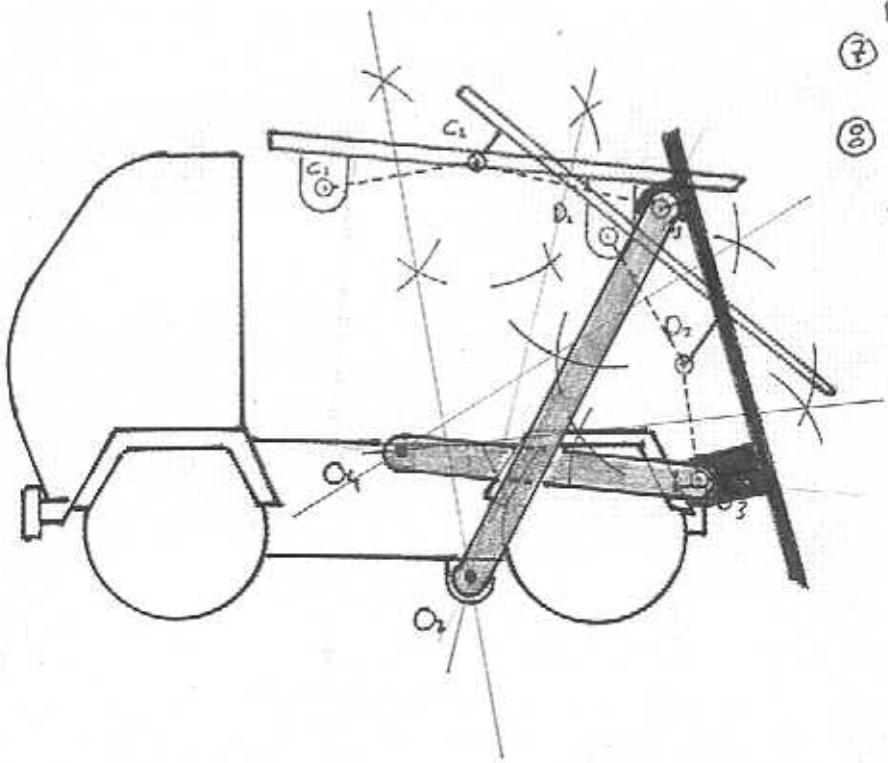
NAME: SOLUTION

PROBLEM 1: For the truck shown, design a linkage that will advance the top of the bucket through the positions shown. Be sure that the linkage attaches to the bed of the truck.

THE SOLUTION IS A FOR THE COUPLER IN THREE POSITIONS. IS SHOWN BELOW IN BOTH THE INITIAL AND FINAL POSITION. THE SOLUTION METHOD IS AS FOLLOWS

1. DISPLACEMENTS C_1C_2 AND C_2C_3 DRAWN
2. DISPLACEMENT CORDS C_1C_2 AND C_2C_3 ARE BISECTED
3. ROTOPOLE O_2 IS LOCATED AT THE INTERSECTION OF THE C_1C_2 AND C_2C_3 BISECTORS.
4. DISPLACEMENTS D_1D_2 AND D_2D_3 ARE DRAWN
5. THE DISPLACEMENT CORDS D_1D_2 AND D_2D_3 ARE BISECTED
6. ROTOPOLE O_4 IS LOCATED AT THE INTERSECTION OF THE D_1D_2 AND D_2D_3 BISECTOR
7. O_2 AND O_4 ARE ATTACHED TO THE TRUCK
8. A LINK CONNECTS O_2 TO C AND ANOTHER LINK CONNECTS O_4 TO D.





PROBLEM 2: Design the linkage that is grounded at O_2 and O_4 that will carry link CD through the three positions shown.

THIS PROBLEM GIVES THREE COUPLER POSITIONS ~~COUPLER~~ WITH ~~THREE~~ TWO GROUND POSITIONS SPECIFIED. THE SOLUTION WILL REQUIRE AN "INVERSION". THE "INVERSION" WILL GROUND C_1D_1. THE POSITION OF O_2O_4 WITH RESPECT TO C_2D_2 AND C_3D_3 MUST BE FOUND, THESE O_2O_4 POSITIONS WILL BE DESIGNATED $O_2'O_4'$ AND $O_2''O_4''$.

① C_1D_1 IS INVERTED AS THE GROUND LINK

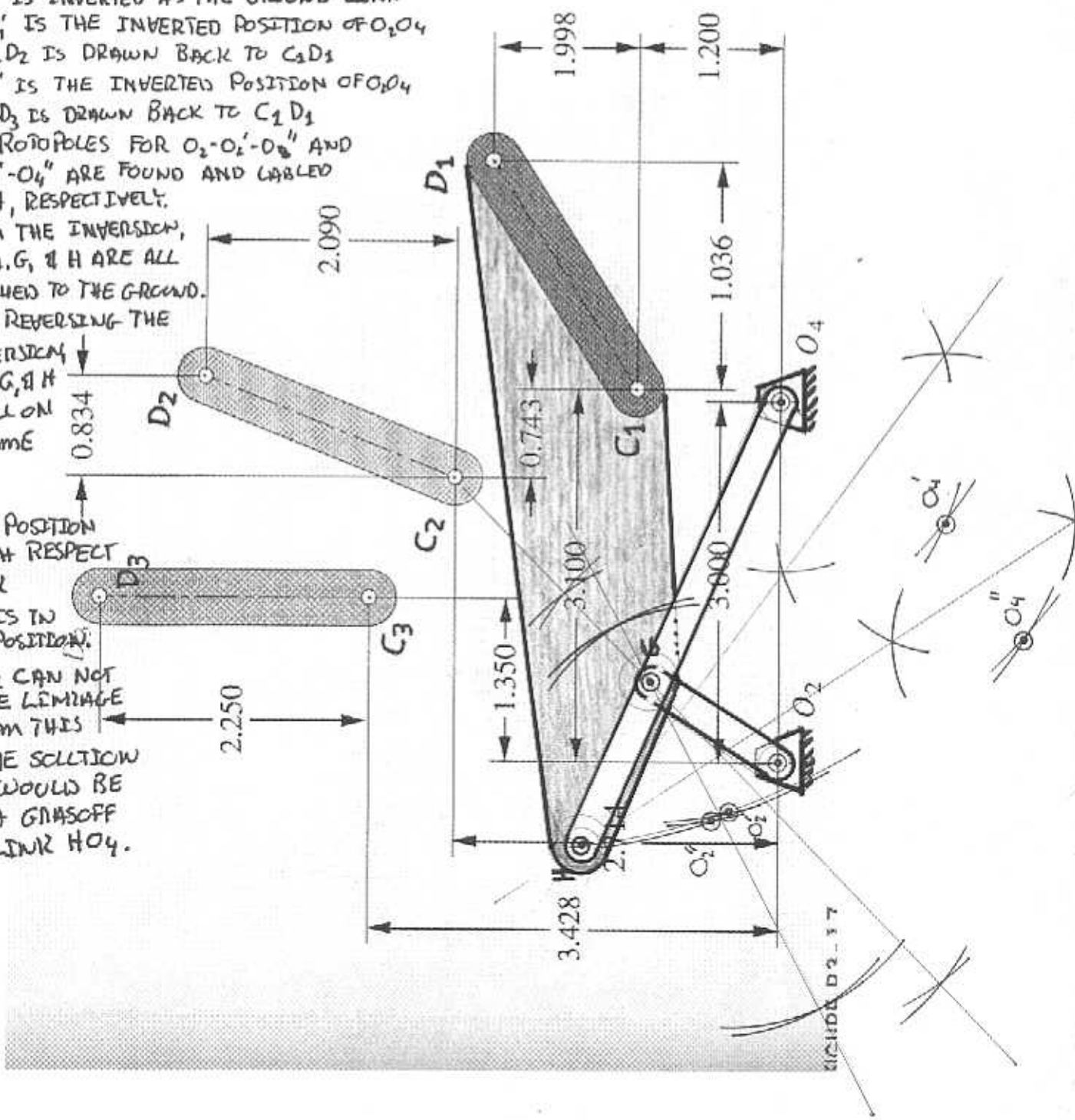
② $O_2'O_4'$ IS THE INVERTED POSITION OF O_2O_4 IF C_2D_2 IS DRAWN BACK TO C_1D_1

③ $O_2''O_4''$ IS THE INVERTED POSITION OF O_2O_4 IF C_3D_3 IS DRAWN BACK TO C_1D_1

④ THE ROTOPOLES FOR O_2-O_2'-O_2'' AND O_4-O_4'-O_4'' ARE FOUND AND LABLED G & H, RESPECTIVELY.

⑤ FROM THE INVERSION, $C_1, D_1, G,$ & H ARE ALL ATTACHED TO THE GROUND. UPON REVERSING THE "INVERSION" $C_1, D_1, G,$ & H ARE ALL ON THE SAME LINK.

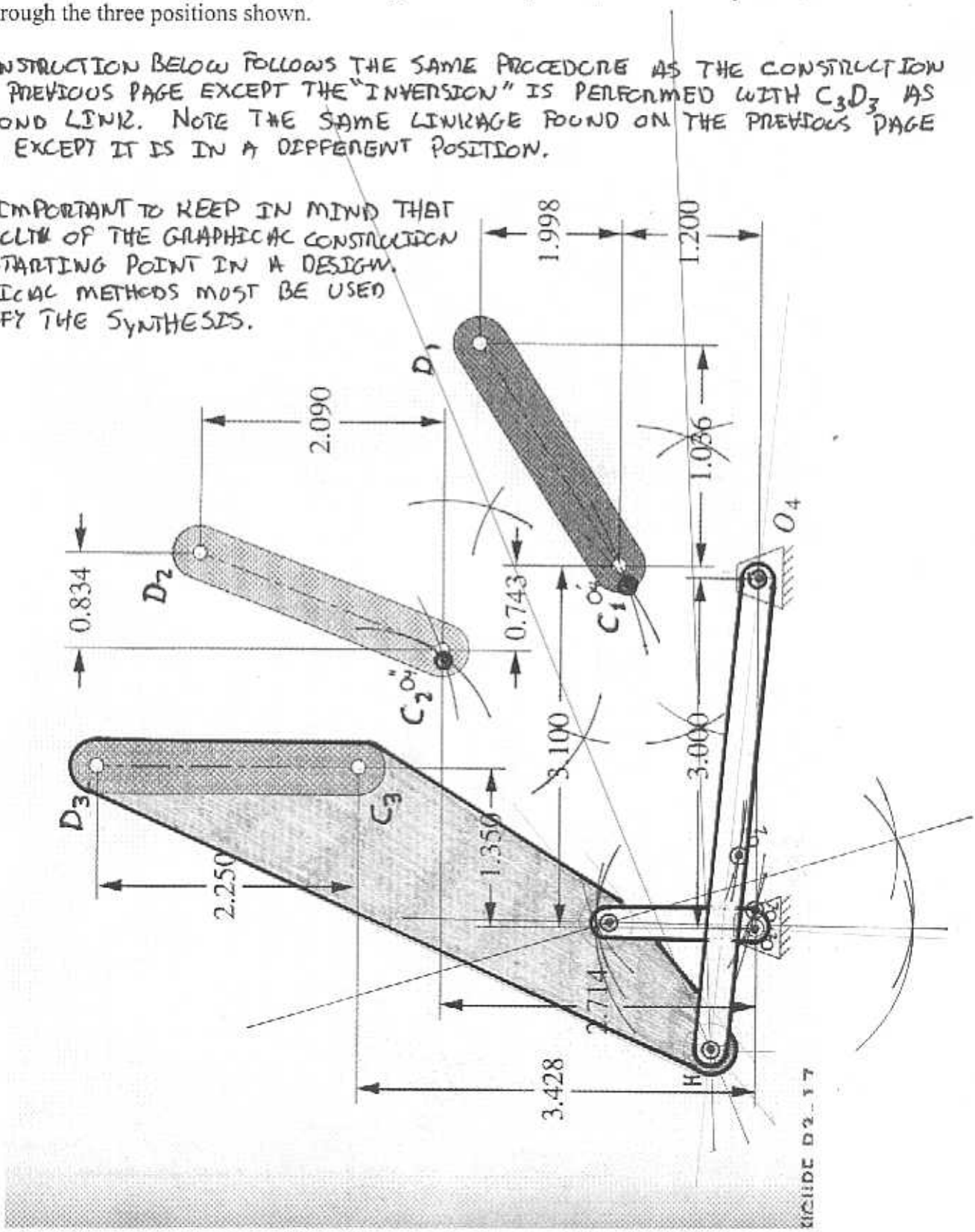
NOTE THE POSITION OF G WITH RESPECT TO ~~H~~ LINK HO_4. G IS IN A TOGGLE POSITION. LINK GO_2 CAN NOT DRIVE THE LINKAGE AWAY FROM THIS POINT. THE SOLUTION TO THIS WOULD BE TO ADD A GRASHOFF DYAD TO LINK HO_4.



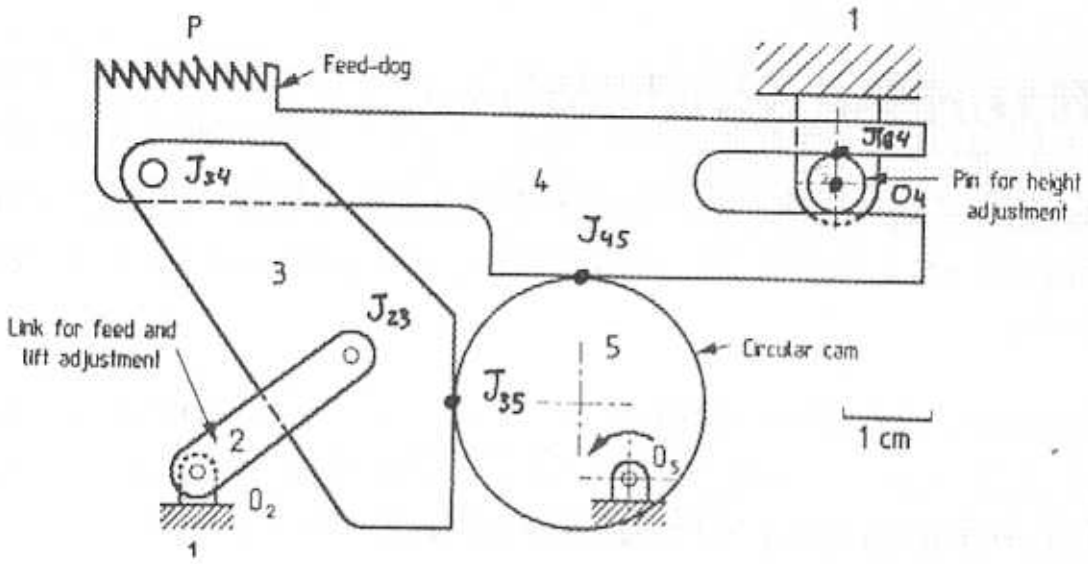
PROBLEM 2: Design the linkage that is grounded at O_2 and O_4 that will carry link CD through the three positions shown.

THE CONSTRUCTION BELOW FOLLOWS THE SAME PROCEDURE AS THE CONSTRUCTION ON THE PREVIOUS PAGE EXCEPT THE "INVERSION" IS PERFORMED WITH C_3D_3 AS THE GROUND LINK. NOTE THE SAME LINKAGE FOUND ON THE PREVIOUS PAGE RESULTS, EXCEPT IT IS IN A DIFFERENT POSITION.

IT IS IMPORTANT TO KEEP IN MIND THAT THE RESULTS OF THE GRAPHICAL CONSTRUCTION IS A STARTING POINT IN A DESIGN. ANALYTICAL METHODS MUST BE USED TO VERIFY THE SYNTHESIS.



PROBLEM 3: For the linkage shown, identify each link and its order; identify each joint, its type, and order; and determine the overall DOF or the mechanism and draw the representative isomer.

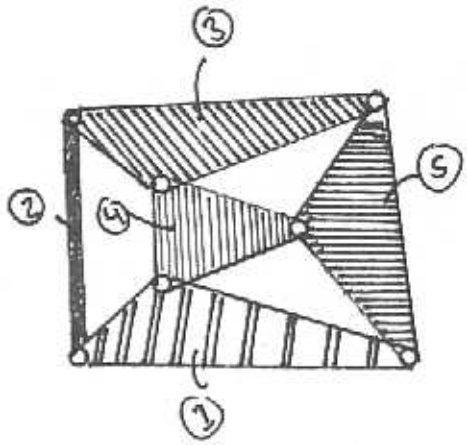


LINK	NODES	TYPE
1	3	TERNARY
2	2	BINARY
3	3	TERNARY
4	3	TERNARY
5	3	TERNARY

JOINT	DOF	CONTACT TYPE	TYPE
O_2	1	LOWER PAIR	REVOLUTE
J_{23}	1	LOWER PAIR	REVOLUTE
J_{34}	1	LOWER PAIR	REVOLUTE
J_{45}	2	HIGHER PAIR	ROLL-SLIDE
J_{35}	2	HIGHER PAIR	ROLL-SLIDE
O_5	1	LOWER PAIR	REVOLUTE
J_4	1	HIGHER PAIR	ROLL-SLIDE

$$M = 3(5-1) - 2\cdot(4) - (3)$$

$$= \boxed{1}$$



THE ISOMER IS FOUND FROM THE MOBILITY CONSTRAINTS

$L = 5$

$M' = M - 3$ (THREE IS SUBTRACTED FROM M BECAUSE BECAUSE FULL JOINTS ~~WERE~~ REPLACED HALF JOINTS REDUCE THE MOBILITY DOF BY 1, THERE ARE 3 HALF JOINTS PRESENT.)

$L - 3 - M' = T + 2Q + 3P \Rightarrow 5 - 3 - (-2) = \boxed{4 = T}$

$L = B + T + Q \Rightarrow 5 = B + 4 \Rightarrow \boxed{B = 1}$