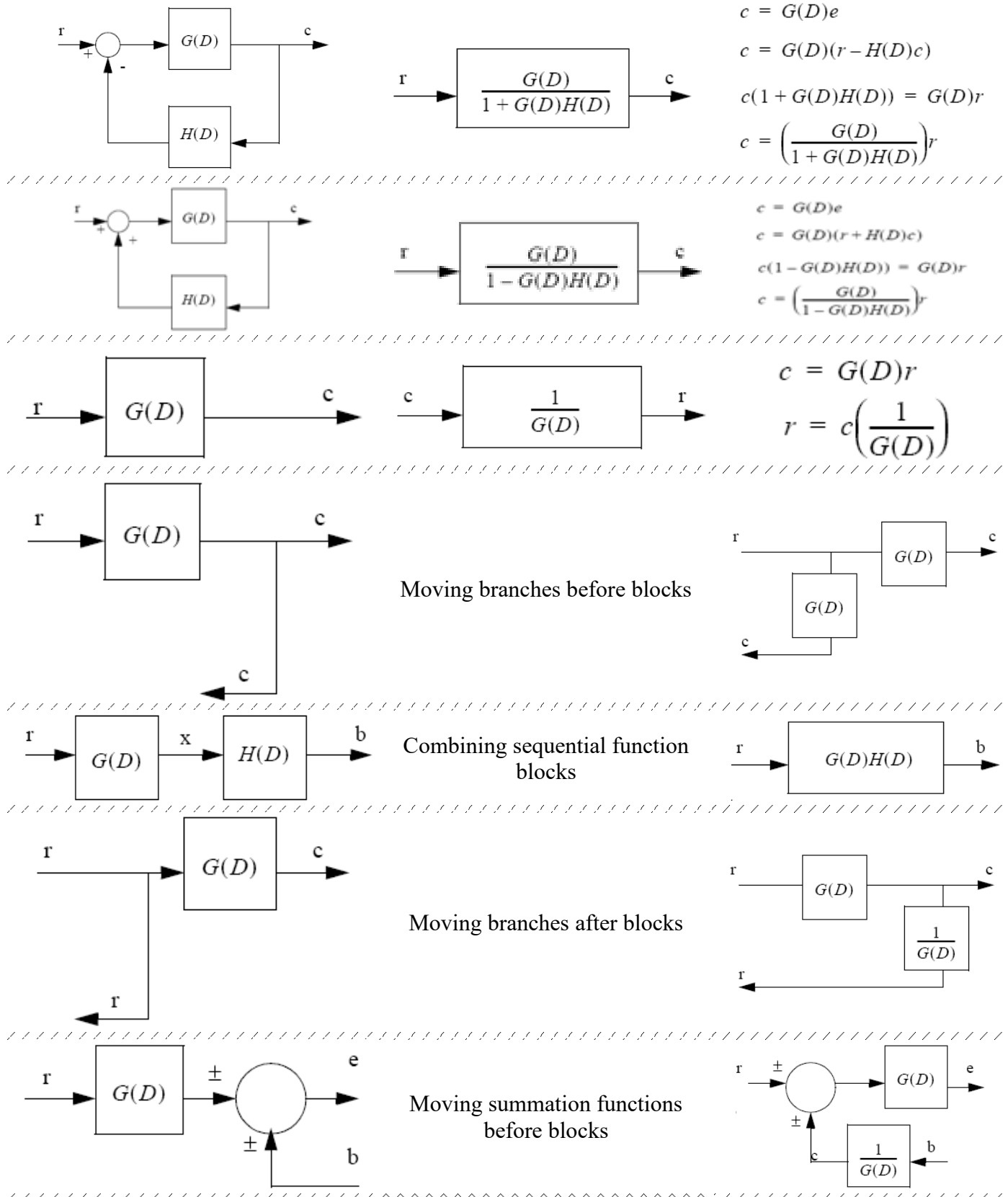
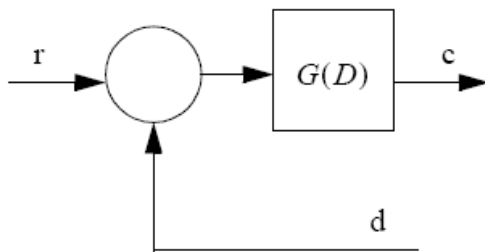
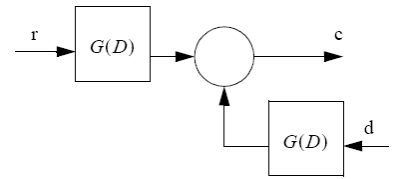


## Block Diagram Reduction



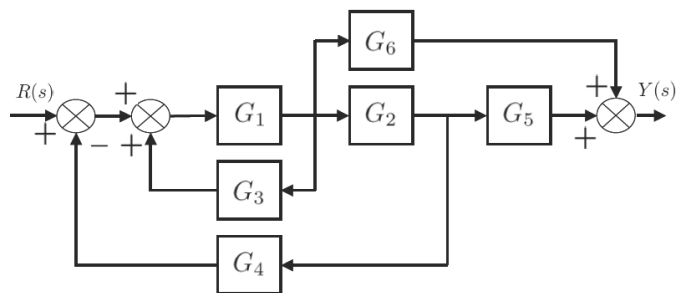


Moving summation function past blocks



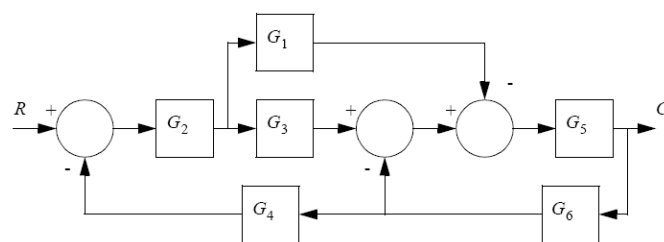
## PROBLEMS

- » Simplify the following block diagrams and obtain the closed-loop transfer functions
- 1)

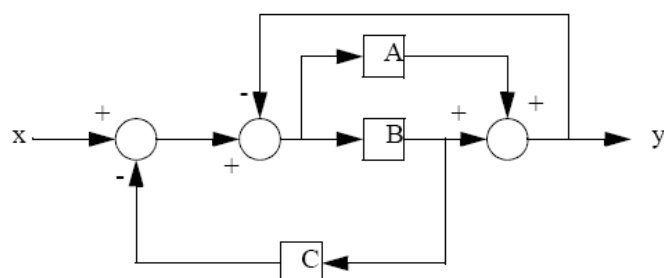


Ans.  $\frac{Y(s)}{R(s)} = \frac{G_1 G_2 G_5 + G_1 G_6}{1 - G_1 G_3 + G_1 G_2 G_4}$

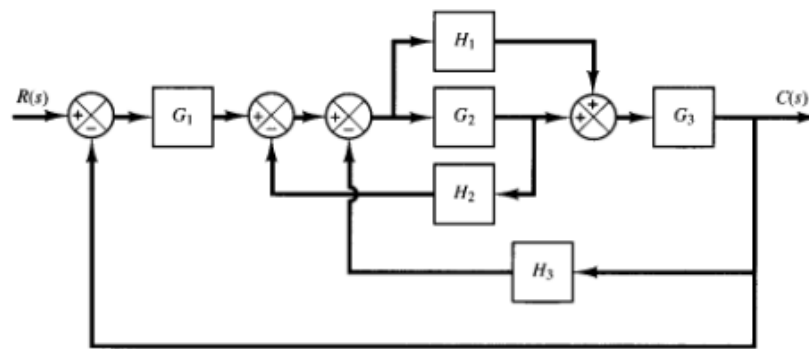
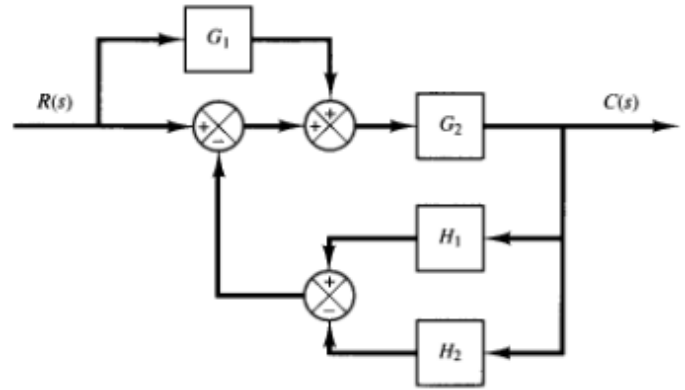
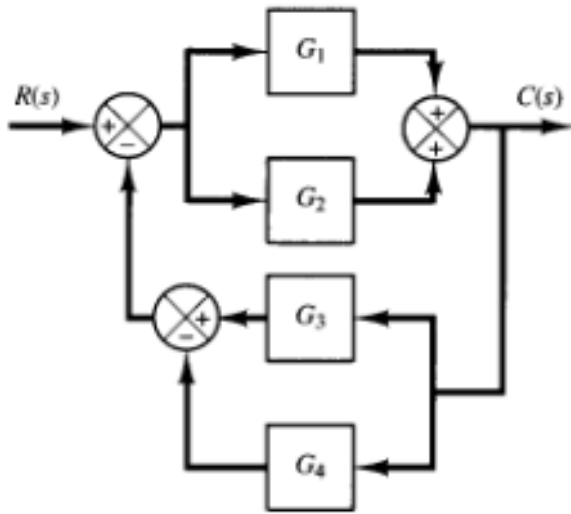
2)



3)



4)



| Transformation                                                 | Equation                | Block diagram | Equivalent block diagram |
|----------------------------------------------------------------|-------------------------|---------------|--------------------------|
| 1. Combining blocks in cascade                                 | $Y = (G_1 G_2) X$       |               |                          |
| 2. Combining blocks in parallel; or eliminating a forward loop | $Y = G_1 X \pm G_2 X$   |               |                          |
| 3. Removing a block from a forward path                        | $Y = G_1 X \pm G_2 X$   |               |                          |
| 4. Eliminating a feedback loop                                 | $Y = G_1 (X \pm G_2 Y)$ |               |                          |
| 5. Removing a block from a feedback loop                       | $Y = G_1 (X \pm G_2 Y)$ |               |                          |
| 6. Rearranging summing points                                  | $Z = W \pm X \pm Y$     |               |                          |
| 7. Moving a summing point ahead of a block                     | $Z = GX \pm Y$          |               |                          |
| 8. Moving a summing point beyond a block                       | $Z = G(X \pm Y)$        |               |                          |
| 9. Moving a take-off point ahead of a block                    | $Y = GX$                |               |                          |
| 10. Moving a take-off point beyond a block                     | $Y = GX$                |               |                          |