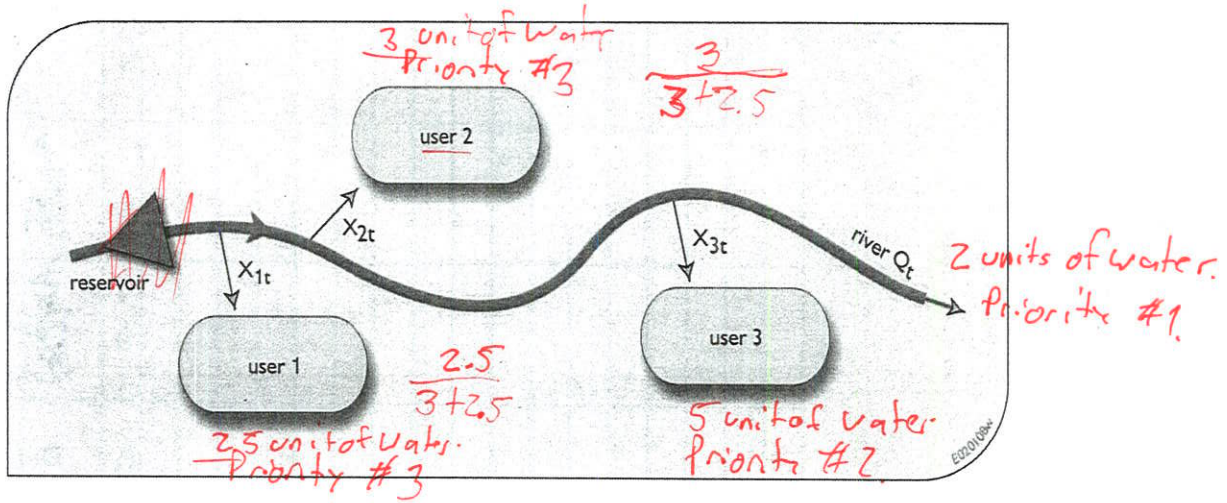
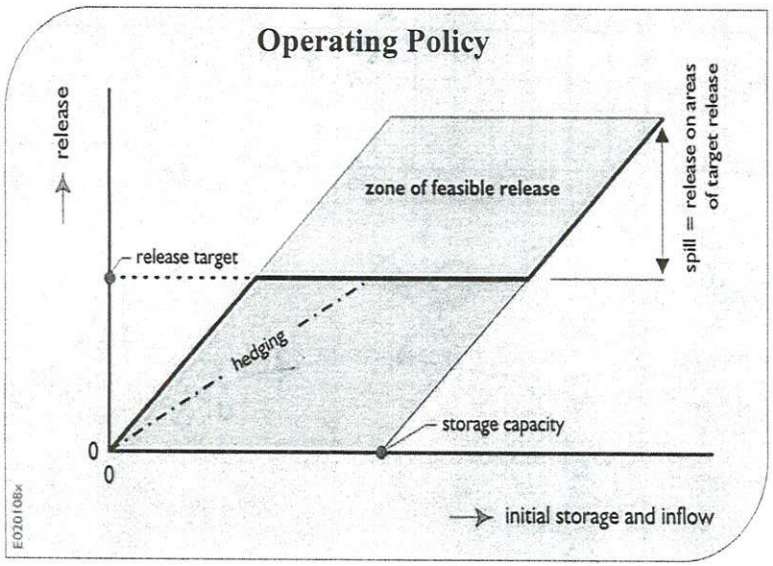
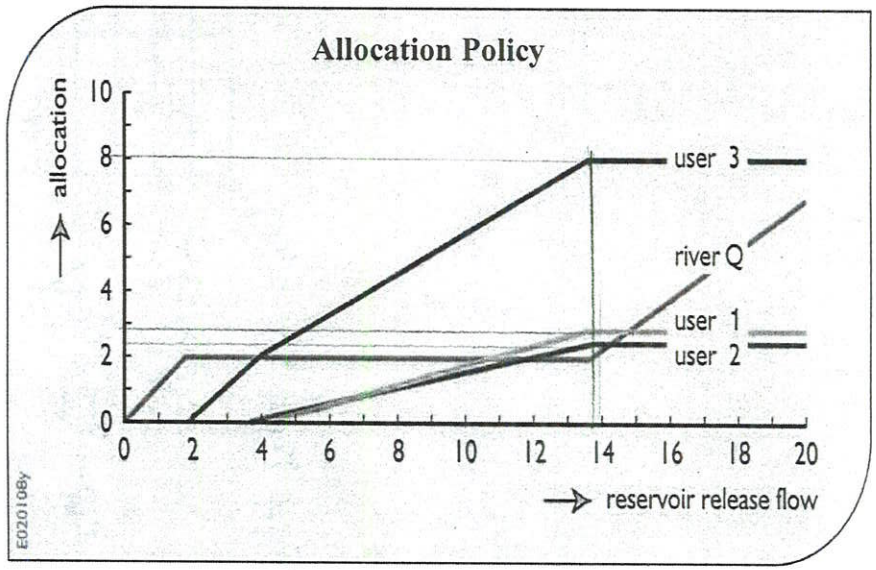
NEED FOR TOOLS ...

Allocate reservoir release R_t to 3 users and provide instream flow Q_t

5.5 units



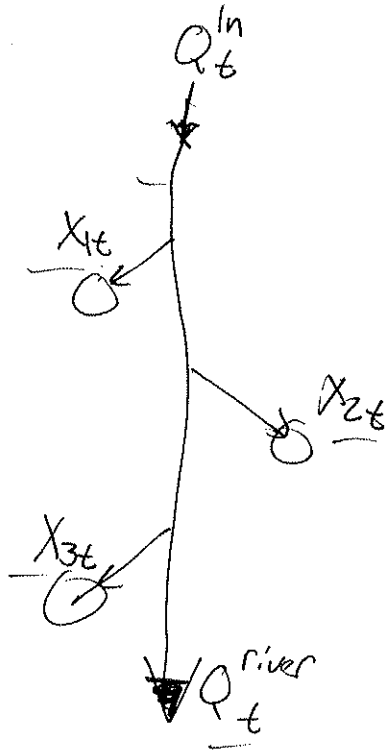




Water Demands				
Priority	1	3	3	2
Name	River	User 1	User 2	User 3
Nickname	(Q_t)	(X_{1t})	(X_{2t})	(X_{3t})
Volume	2	2.5	3	5

4 ~~7~~ 5.5 unit.

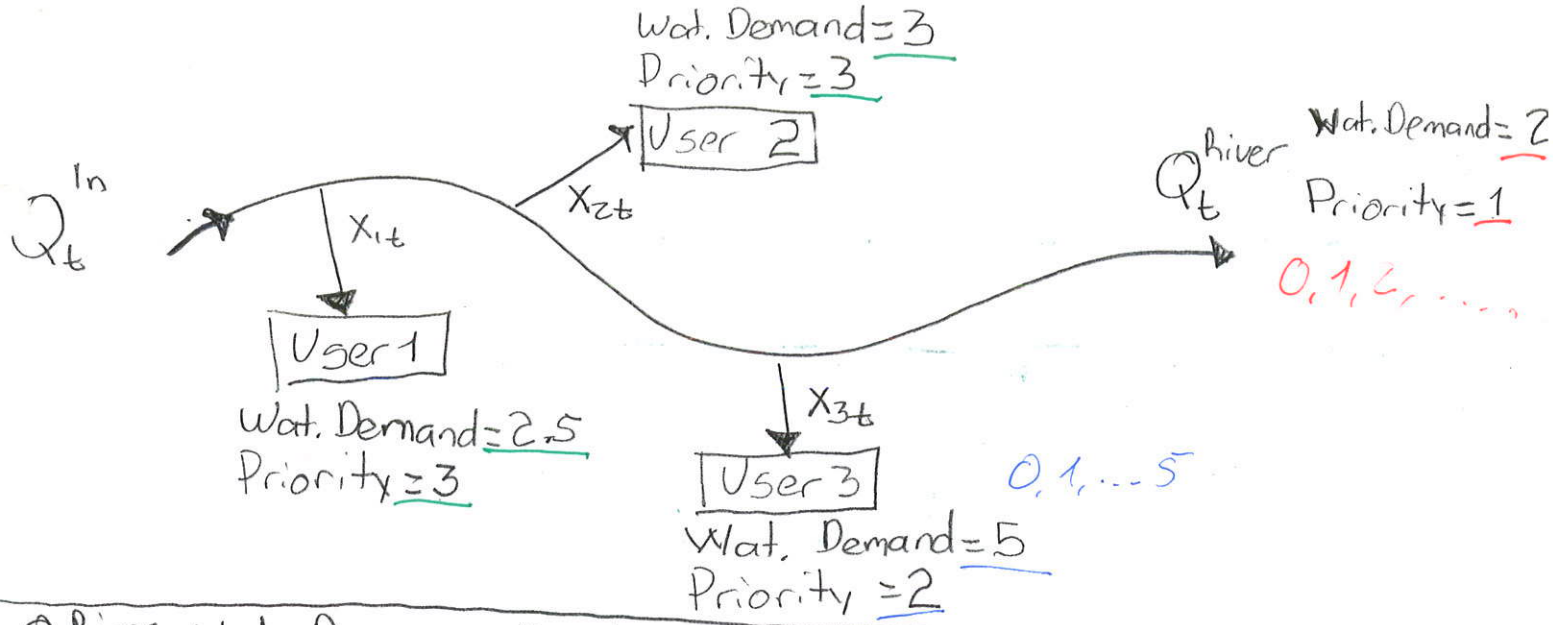
	Q_t^{In}	1 (Q_t)	3 (X_{1t})	3 (X_{2t})	2 (X_{3t})	Probation
2015	14	2+1.5=3.5	2.5	3	5	12.5
2016	11	2	$4\times(\frac{2.5}{5.5})$	$4\times(\frac{3}{5.5})$	5	
2017	9					
2018	0	0	0	0	0	
2019	9					
2020	19					
2021	13					
2022	16					
2023	20					
2024	9					
2025	15					
2026	7					
2027	16					
2028	12					
2029	26					
2030	21					
2031	23					
2032	7					
2033	5					
2034	11					
2035	8					



$$\Delta S_t = I_t - O_t$$

$$I_t = Q_t^{In}$$

$$O_t = X_{1t} + X_{2t} + X_{3t} + Q_t^{river}$$



▶ Q_t^{River} ; Wat. Dem. = 2; Priority = 1

$$Q_t^{River} = \begin{cases} Q_t^{In} & \text{if } Q_t^{In} < 2 \quad 0, 1, \\ 2 & \text{if } Q_t^{In} \geq 2 \text{ and } Q_t^{In} < 2 + \sum_{i=1}^{i=3} X_{it} \\ Q_t^{In} - \sum_{i=1}^{i=3} X_{it} & \text{if } Q_t^{In} > 2 + \sum_{i=1}^{i=3} X_{it} \end{cases}$$

▶ User 3, Wat. Demand = 5, Priority = 2

$$X_{3t} \begin{cases} 0 & \text{if } Q_t^{In} \leq Q_t^{River} \\ 5 & \text{if } Q_t^{In} > Q_t^{River} + X_{3t} \\ Q_t^{In} - Q_t^{River} & \text{if } Q_t^{In} > Q_t^{River} \text{ and } Q_t^{In} < Q_t^{River} + X_{3t} \end{cases}$$

- User 1, Wat. Demand = 2.5 Priority = 3

$$X_{1t} = \begin{cases} 0 & \text{if } Q_t^{In} < Q_t^{River} + X_{3t} \\ 2.5 & \text{if } Q_t^{In} - (Q_t^{River} + X_{3t}) > X_{1t} + X_{2t} \\ \left[Q_t^{In} - (Q_t^{River} + X_{3t})\right] \times \left(\frac{X_{1t}}{X_{1t} + X_{2t}}\right) & \text{if } Q_t^{In} - (Q_t^{River} + X_{3t}) < X_{1t} + X_{2t} \text{ and } Q_t^{In} > Q_t^{River} + X_{3t} \end{cases}$$

- User 2, Wat Demand = 3.0 ; Priority = 3

$$X_{2t} = \begin{cases} 0 & \text{if } Q_t^{In} < Q_t^{River} + X_{3t} \\ 3 & \text{if } Q_t^{In} - (Q_t^{River} + X_{3t}) > X_{1t} + X_{2t} \\ \left[Q_t^{In} - (Q_t^{River} + X_{3t})\right] \times \left(\frac{X_{2t}}{X_{1t} + X_{2t}}\right) & \text{if } Q_t^{In} - (Q_t^{River} + X_{3t}) < X_{1t} + X_{2t} \text{ and } Q_t^{In} > Q_t^{River} + X_{3t} \end{cases}$$

For Reservoir,
Substitute Q_t^{In} for $S_{t-1} + Q_t^{In}$