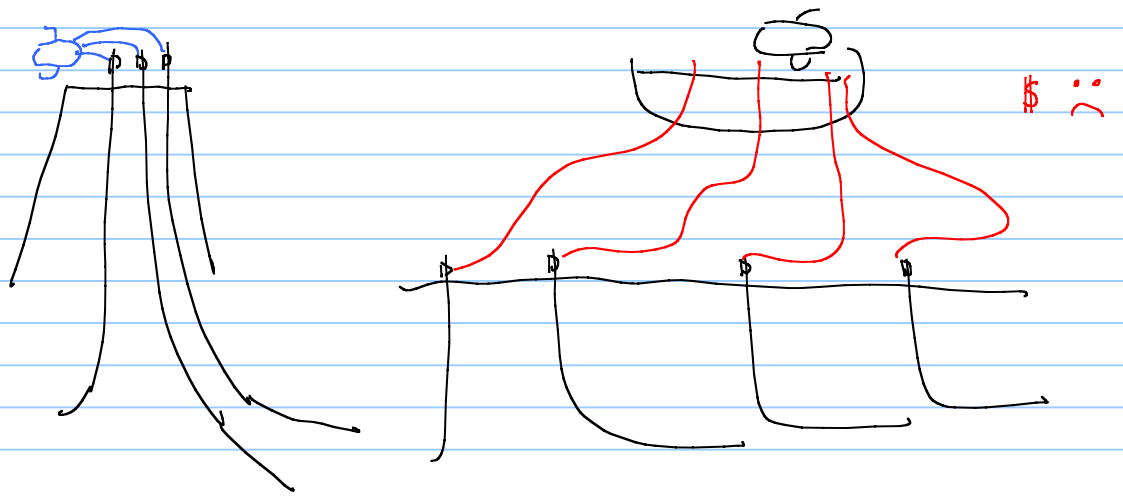
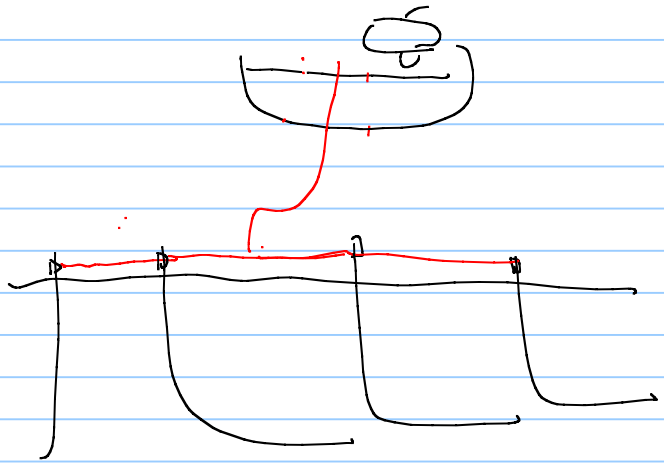
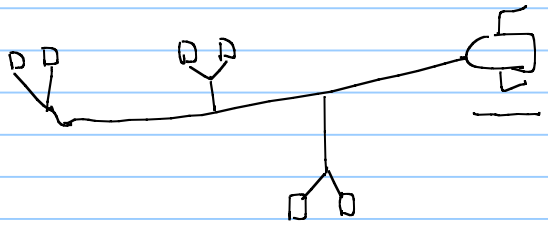
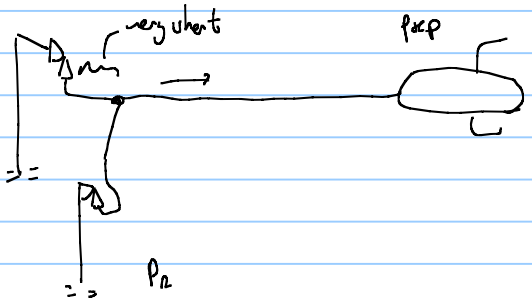
- Networks collection of pipes, flowline, pipeline, valves, pumps, take the fluids from wells to the processing facilities.







Example: 2 Drainage wells

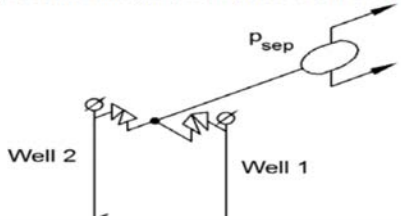


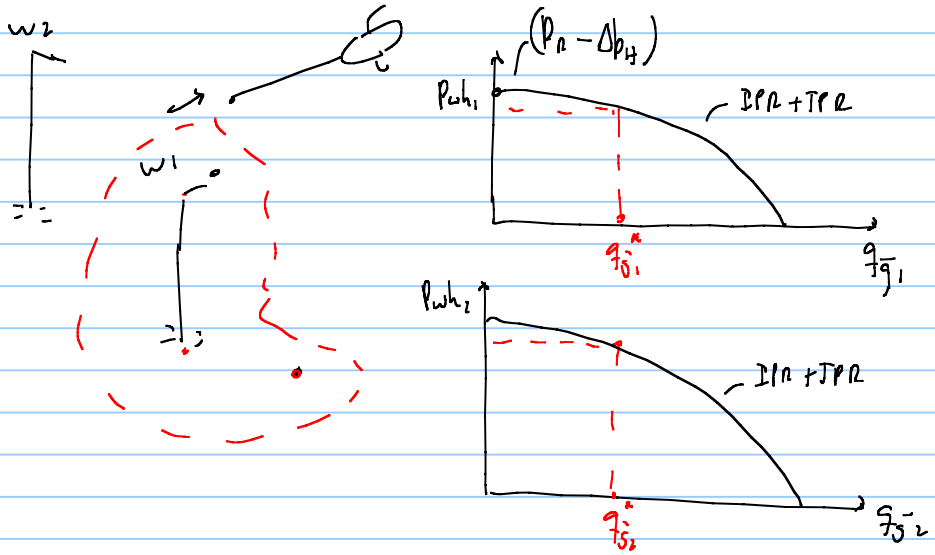
open choke $\Delta p_{c_1} = 0$ $\Delta p_{c_2} = 0$

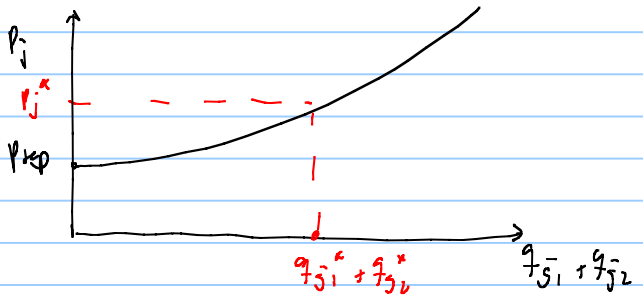
Equations	Nr equations	Nr unknowns
IPR, $q_{j_1} = C_{R_1}(\bar{p}_{R_1}^2 - p_{wf_1}^2)^{n_1}$ $q_{j_2} = C_{R_2}(\bar{p}_{R_2}^2 - p_{wf_2}^2)^{n_2}$	2	4
TPR $q_{j_1} = C_{T_1}\left(\frac{p_{wf_1}^2}{e^{s_1}} - p_{wh_1}^2\right)^{0.5}$ $q_{j_2} = C_{T_2}\left(\frac{p_{wf_2}^2}{e^{s_2}} - p_{wh_2}^2\right)^{0.5}$	2 | 4	2 | 6
PPR $q_{j_1} + q_{j_2} = C_{pl}\left(p_j^2 - p_{sep}^2\right)^{0.5}$	1 | 5	1 | 7
$\Delta p_{c_1} = 0$ $p_{wh_1} = p_j$	1 | 6	0 | 7
$\Delta p_{c_2} = 0$ $p_{wh_2} = p_j$	1 | 7	0 | 7

PROBLEM 4 (18 POINTS). Network solving. (2017) exam

Consider the gas field with two wells, a manifold a pipeline and a separator shown in the figure below. The wellhead of the wells are very close to the junction so it can be safely assumed that the wellhead pressure and junction pressure are equal when the choke is open.







approach nr. 1

1: assume $q_{sc_1}^*$ $q_{sc_2}^*$

2: Read $p_{wh_1}^*$, $p_{wh_2}^*$, p_j^*
(WPR_1) (WPR_2) (PPR)

3: Verify $p_{wh_1}^* = p_{wh_2}^* = p_j^*$

not

yes

$q_{sc_1}^*$, $q_{sc_2}^*$ are solution

approach nr. 2

1. assume $p_j^{*0} = p_{wh_1}^{*0} = p_{wh_2}^{*0}$

2. Read $q_{sc_1}^{*0}$ (WPR_1), $q_{sc_2}^{*0}$ (WPR_2), $q_{pipeline}^*$ (PPR)

3. Verify $q_{sc_1}^* + q_{sc_2}^* = q_{pipeline}^*$

not

yes

solution

1st iteration $p_j = 50$ bara

$q_{fg_1}^{IPR} = 1.2\,E06$ Sm³/d

$q_{fg_1}^{*} = 1.57\,E06$ Sm³/d + 2.77 E6 Sm³/d $\quad \varepsilon = 0.97 - 1E06$ Sm³/d

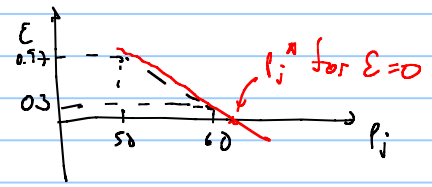
$q_{pipeline}^{*} = 1.8\,E06$ Sm³/d 1.8 E06 Sm³/d

2nd $p_j = 60$ bara

$q_{pipeline}^{*} = 2.3\,E06$ Sm³/d 2.3 E06 Sm³/d $\quad \varepsilon = 0.3 - 1E06$ Sm³/d

$q_{fg_2}^{*} = 1.45\,E06$ Sm³/d + 2.60 E06 Sm³/d

$q_{fg_1}^{*} = 1.15\,E06$ Sm³/d



$$\frac{\varepsilon_1 - \varepsilon_2}{p_{j_1} - p_{j_2}} = \frac{\varepsilon_1 - 0}{p_{j_1} - p_j^*}$$

$p_j^* = \sim$