Regarding the FTA and RBD (Reliability Block Diagram)

Just in case, some of you missed today's tutorial or still are not very clear about the differences between FTA and RBD. As discussed during the class and tutorial, FTA is an example of adopting the concept of **Negative logic** and RBD is an example of adopting the concept of **Positive logic**. When you work on a method developed through the concept of negative logic such as FTA, it is very important that you understand that it is all about the failures and what will occur after the failures. To use this type of method, you need first to assume the failures of studied component(s) or system. On the other hand, the method developed through the concept of positive logic focus on the working state of the component(s) or system(s). To use this type of method, you need to assume that the studied component(s) or system function correctly. For example, if you would like to go to London for a weekend, assume that you can only choose to take train or flight. In the of negative logic, the failure of this trip is caused by the unavailability of the train **AND** the flight during the weekend. Therefore, an **AND** gate can be used to describe this situation. If you want to describe it in then term of the positive logic, you can say "OK, the goal of going to London can be achieved by either taking the train **OR** taking the flight ". Therefore, an **OR** gate can be used to describe this situation. As you can see, for same situation, the logic used to describe it varies.

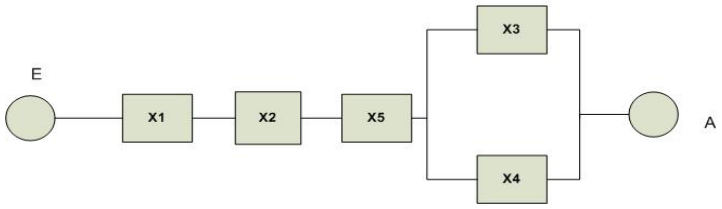
Let's make a RBD to calculate the probability of the event : ***Not working of EP1***. Assuming

$\overline{X1}$: Failure of PLC1 Probability: q1= 9.9999E-5	$\overline{X2}$: Failure of FT1 Probability: q2= 5E-5
$\overline{X3}$: Lost of power supply Probability: q3= E-4	$\overline{X4}$: Lost of backup power supply Probability: q4= 1E-3
$\overline{X5}$: Failure of EP1 Probability: q5= 7.937E-3	$\overline{X}$: Not working of EP1

According to the solution for tutorial 4, Here is the logic function for this event, which is developed using the Negative logic concept (FTA).

$\overline{X}$ = ($\overline{X1}$ Or $\overline{X2}$) or ($\overline{X3}$ And $\overline{X4}$) or $\overline{X5}$ (1)

Converting (1) to RBD (positive logic), we can get this block:



As you can see from the block above, during the conversion, AND logic has been changed to OR logic and Or logic has been changed to AND logic. Now let's try to calculate the failure probability of this event using this block according to the data the table above.

$F=1-((1-q1)\times(1-q2)\times(1-q5)\times(1-q3\times q4))= 8.1E-3$

Compare this result with the results from FTA, it is same.

From this example, I am trying to show you how to solve this type of question by using two different methods (FTA and RBD).