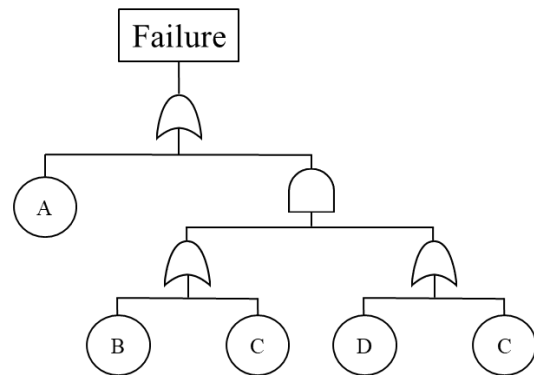
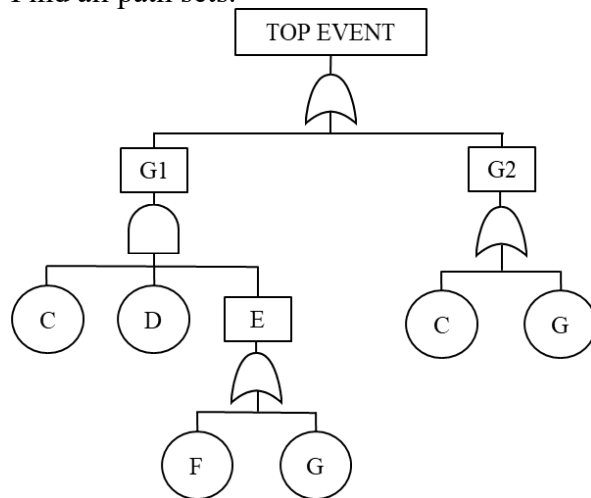


ENRE 447 Homework 7

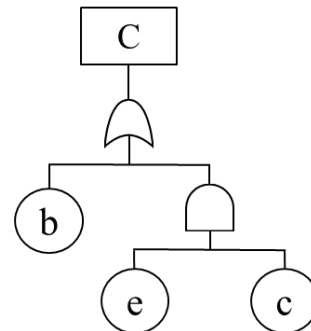
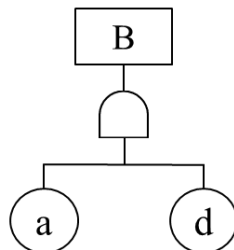
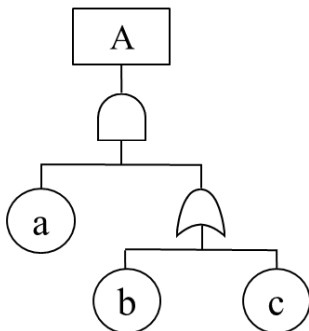
1. For the following fault tree, find:
 - a. The minimal cut sets,
 - b. The mutually exclusive cut sets using the truth table method (you should develop the entire truth table and show the end effect of each set, whether they lead to system failure or not).
 - c. Using two Venn Diagrams show that the cuts sets leading to failure of the system obtained in a) and b) are identical.



2. Evaluate the following fault tree by doing the following
 - a. Find the minimal cut sets of the top event.
 - b. If the probability of each basic event is 0.005 and events are independent, find the probability of the occurrence of top event.
 - c. Find all path sets.



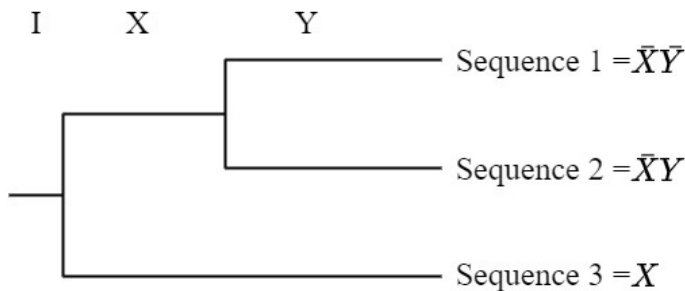
3. Given the following event tree and fault trees,



I	A	B	C	Overall system result
				Success
				Failure
				Failure
				Failure

Notation: Use A to denote the event that system A fails, \bar{A} for the event that system A operates (success).

- Find the minimal cut sets of each subsystem and the expression for the system logic for the three sequences leading to system failure
 - If $Pr(a) = Pr(b) = Pr(c) = Pr(d) = Pr(e) = 0.1$, find the probability of failure of this system. Use the rare event approximation.
4. [6.28] An event tree is used in reactor accident estimation as shown, where Sequence 1 is a system success and Sequence 2 and Sequence 3 are system failures. The minimal cut sets of subsystems X and Y are $X = AB + AC + D$ and $Y = BD + E + A$. As typical, use A to denote the event that system A fails, \bar{A} for the event that system A operates successfully. Find the cut sets of Sequence 2 and Sequence 3.



5. (Wait until after we do the FMEA activity in class to do this problem). Read the article LaFleur, C. B.; Muna, A. B.; Groth, K. M.; St. Pierre, M. & Shurland, M. "Failure analysis of LNG rail locomotives." *Proceedings of the 2017 Joint Rail Conference (JRC2017)*. The American Society of Mechanical Engineers (ASME), Philadelphia, PA, April 4-7, 2017. (Available on Canvas or at: doi:10.1115/JRC2017-2275):

Submit a 1 page, well-written document (roughly 500 words) which contains two elements: a short summary of the article and your reflection on the article. The summary should be in your own words. You may reflect on any aspect of the article.

If you need some prompts for reflection, consider answering one or more of the following questions: How does this relate to your work or the topic that motivated you to take this class? Would you have done anything differently? How does it relate to what you experienced doing the FMEA in class? Do you have any question after reading the article? What surprised you? What did you learn?