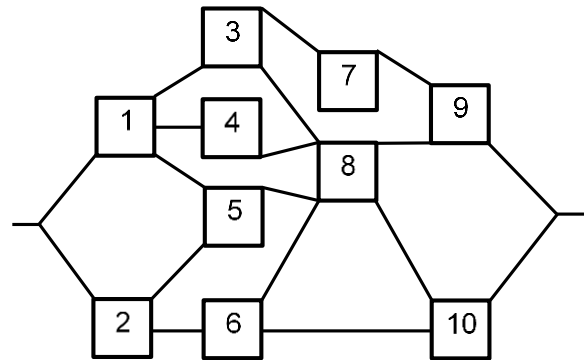
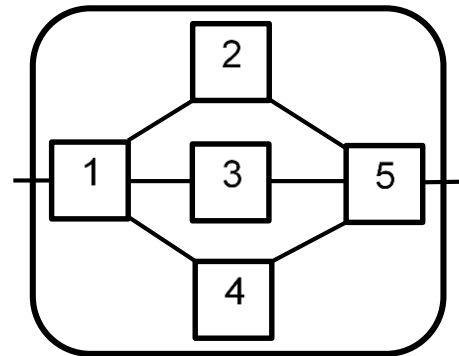


- I. (80 points) All questions apply to the system shown. For 1 – 3, assume the components to be independent, and for 4 – 8 also assume that they are also identically distributed.



1. Find the minimal path sets and minimal cut sets for the system.
2. Sketch the equivalent systems using minimal path sets and minimal cut sets.
3. Find the structure function for the system using both the minimal path sets and minimal cut sets. Also, show that the structure functions from the two methods are identical.
4. Find the reliability of the system, if the component reliability is p .
5. Find the simple series lower bound and the simple parallel upper bound for the system reliability, if the component reliability is p .
6. Find the cut set lower bound and the path set upper bound for the system reliability, if the component reliability is p .
7. Graph the system reliability and the four bounds on the same graph.
8. Assume that the time-to-failure T for each component has a two-parameter Weibull cdf with shape parameter $\alpha = 2.5$ and scale parameter $\beta = 15.0$ years.
 - a. Find the reliability of the system, and graph it on two-parameter Weibull probability paper.
 - b. Find the median time-to-failure of the system.
 - c. Find the mean time-to-failure of the system.
 - d. Find the coefficient of variation of the time-to-failure of the system.
 - e. Find the allowable time in service, if a reliability of 0.999 is desired.
 - f. Find the reliability of the system for a time in service of 25 years.

- II. (40 points) Consider the figure shown where the five components in the unit are independent and identically distributed:



1. Determine the reliability of the unit considered as a system where the reliability of each component is p .
2. In order to make a more reliable structure the system with the five components is, in turn, used as components in a three-out-of-five structure. Assuming that the systems in the structure are independent and identically distributed, determine the reliability of the three-out-of-five structure.
3. As the underlying component reliability p ranges over the interval $[0, 1]$, graph the reliabilities for the the system and structure.
4. Determine for which values of p when the three-out-of-five structure is more reliable.