

**COE 444 - Internetwork Design and Management
Fall 2003 (Term 031)**

Homework 12

Date: Saturday, December 20, 2003

For the tree network in **Q1 of Homework 11**, assume that the MTBF and MTTR of any link are respectively 5 years and 1 day, and the MTBF and MTTR of any switch are respectively 15 years and 5 days. (1 year = 365.25 days)

1. Find P_l and P_s , the links and switches reliabilities (use precision at 10^{-5})
2. Find the overall network reliability, that is, the probability that the network is connected.
3. Find $E(B_1)$, the expected number of nodes communicating with the root node B_1 . Recall that, for any node i :

$$E(i) = P_i \times (1 + \sum_{k \in \text{Succ}(i)} P_{j_k} E(k))$$

where j_k is the link between node i and its successor node k .

4. Find $EPR(B_1)$, the expected number of node pairs communicating through the root node B_1 . Recall that,

$$EPR(B_1) = \sum_{\substack{i, k \in \text{Succ}(B_1) \\ i \neq k}} P_{B_1} P_{j_i} E(i) P_{j_k} E(k) + \sum_{i \in \text{Succ}(B_1)} P_{B_1} P_{j_i} E(i)$$

where P_{j_i} and P_{j_k} are respectively the reliabilities of the links between nodes i and k and the root B_1 . P_{B_1} is the reliability of switch B_1 , and $E(i)$, $E(k)$ are as defined above.