

Mobile Communications

Problem Set 5

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1. Does ALOHA suffer from the "hidden and exposed station" problem?
2. Consider light bulbs that fail after some iid random time that is exponentially distributed. A single bulb is used at a time and replaced immediately if it fails. The time between failures X is exponentially distributed with mean of $E[X] = 200$ hours. Given that a light bulb has been running for 30 hours what is the probability that the light bulb does not fail before overall 230 hours ?

(Hint: Regard this process as a renewal process. The exponential distribution has a remarkable property.)

3. We decide to use the following car replacement strategy. Cars possess an iid lifetime X that is distributed according to some distribution F . A new car costs C . Dumping a car costs D .

We start with a new car (car number 0) at time $t = 0$. If the car is working after time T we give it away for free and buy a new car for C . If the car is broken before T we pay $C + D$ for dumping the old car and buying a new one immediately.

- What is the long term cost of this policy?
- Given that the lifetime of a car X is distributed uniformly between 0 and W . What is the optimal value for the time T after which we give away the car?