

## Traffic

Q1.

1. Discuss the quality factors used in the Telephone Network.

### Discussion on Quality factors:

- a. Congestion and Grade of Service
    - i. Congestion: ratio of calls rejected due to insufficient resources (Switching and / or Transmission) – (Call congestion)  
Time Congestion: cumulative time where all resources are busy or occupied
    - ii. Grade of Service: (Maximum) Congestion value set by the Telephone network service provider
  - b. Answer to Bid ratio
  - c. Answer to Seizure ratio
  - d. Holding Time (average): average period a equipment or trunk is held irrespective whether the call is successful (i.e. answered) or not.
  - e. Conversation Time (average): average period a equipment or trunk is held for a successful (i.e. answered) call
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2. Prove the following
    - a. Answer / Bid = Answer / Seizure (1-Congestion)
    - b. Average Holding Time = ~ (Answer / Seizure ) \* (Average Conversation Time)  
(Approximately equal)

### Proof of A

$$\text{Answer / Bid} = (\text{Answer / Seizure}) / (\text{Seizure / Bid})$$

**Since**, Seizure = Bid – Rejection;

We have,

$$\text{Answer / Bid} = (\text{Answer / Seizure}) / ((\text{Bid} - \text{Rejection}) / \text{Bid})$$

**Since** Congestion = Rejection / Bids;

$$\text{Answer / Bid} = (\text{Answer / Seizure}) / (1 - \text{Congestion})$$

### Proof of B

**Assumption 1:** No calls results as 'Ringing No Answer'

Therefore we have

$$\text{AHT} = (\text{ACT} * \text{Ans.}) + (\text{Avg. Seizure \& Signaling Time} * \text{Ans.}) / \text{Bid}$$

**Assumption 2:** No Rejection ( i.e. Seizure = Bid )

Therefore we have

$$\text{AHT} = (\text{ACT} * \text{Ans.}) + (\text{Avg. Seizure \& Signaling Time} * \text{Ans.}) / \text{Seizure}$$

$$\text{AHT} = (\text{ACT} + \text{Avg. Seizure \& Signaling Time}) * \text{Ans.} / \text{Seizure}$$

**Since:** Avg. Seizure & Signaling Time is << Avg. Conversation Time  
(Very much smaller than)

$$\text{AHT} \sim \text{ACT} * (\text{Ans.} / \text{Seizure}) \quad (\text{approximately})$$

3. In a Telecom Network the observation with regard to two routes of a telephone exchange where 15,000 Customers are connected is given as follows.

MEASUREMENT REPORT (HR)		
REPORT PERIOD :	06/20/05 10:00:01 - 06/20/05 11:00:01	
ROUTE NAME	Route A	Route B
BIDS	2584	664
ANSWER	1222	272
CALLED PARTY BUSY	1028	288
RINGING NO ANSWER	25	30
CARRIED TRAFFIC (ERL)	51.09	10.81
NO OF CIRCUIT EQUIPED	270	119
NO OF CIRCUIT WORKING	270	119

Derive the relevant quality factors for Route A and Route B.  
Assuming Rs.5.00 per Minute will be charged from the customer, calculate the revenue that you can generate from the Route A and Route B during the busy hour.

**Quality factors of this circuit group are follows**

**For Route A :**

- Answer to Bid Ratio =  $1222 / 2584 = 0.47$
  - Answer to Seizure Ratio =  $1222 / 2275 = 0.54$
- (Here seizures means Answer + Called Party Busy + Ringing No Answer )
- Congestion =  $1 - (\text{Seizure} / \text{Bids}) = 1 - (2275 / 2584) = 0.12$
  - Average Holding Time =  $\text{Traffic} / \text{Call Attempts} = 51.09 / 2584 * 3600 = 71.18 \text{ Sec.}$
  - Average Conversation Time =  $\text{Average Holding Time} * (\text{Seizure} / \text{Answer}) = (71.18 * 2275 / 1222) = 132.51 \text{ Sec.}$
- f. Revenue Generated =  $\text{Average Conversation time} * \text{Answer} * \text{Charge} / 60 = 132.51 * 1222 * 5 / 60 = \text{Rs. } 13,493.94$

**For Route B :**

- Answer to Bid Ratio =  $272 / 664 = 0.41$
  - Answer to Seizure Ratio =  $272 / 590 = 0.46$
- (Here seizures means Answer + Called Party Busy + Ringing No Answer )
- Congestion =  $1 - (\text{Seizure} / \text{Bids}) = 1 - (590 / 664) = 0.11$
  - Average Holding Time =  $\text{Traffic} / \text{Call Attempts} = 10.81 / 664 * 3600 = 58.61 \text{ Sec.}$
  - Average Conversation Time =  $\text{Average Holding Time} * (\text{Seizure} / \text{Answer}) = (58.61 * 590 / 272) = 127.13 \text{ Sec.}$
- f. Revenue Generated =  $\text{Average Conversation time} * \text{Answer} * \text{Charge} / 60 = 127.13 * 272 * 5 / 60 = \text{Rs. } 2,881.61$

4. Compare the nature of these two routes.

**Observation on the nature of two routes:**

The nature of two routes is similar since the congestion of both groups is similar.  
The no of circuits that needs to carryout the Carried Traffic is much less than the equipped no of circuits.  
Also there are rejected calls for both routes. Hence this Exchange is overloaded.