Service Operations (SO)

Post Graduate Program 2014-16

Week 6

Vinay Kumar Kalakbandi
Assistant Professor
Operations & Systems Area

Agenda

- Recap
- Mid Term
- Agenda for the rest of the course
- Demo of simulation tools
- Service Quality
- Yield Management

Up Next

- Today: Service Quality
- Next Session: American Airlines case (session 11)
- Next Week (sessions 12,13)
  - Starbucks Case – Even teams
  - Zipcar – Odd Teams
  - McDonalds Case – if time permits
- Guest Lectures (14-17 sessions) 22nd and 23rd August
- The week after (sessions 18,19)
  - Aravind Eyecare – Odd teams
  - ITC e-choupal – Even teams
  - Course Wrapup
- Project Presentations (session 20) – As per your convinience

SERVICE QUALITY

Opening questions

- Your good service experience?
- Your bad service experience?

Journal of Personality and Social Psychology
1998, Vol. 75, No. 4, 887–900

Negative Information Weighs More Heavily on the Brain: The Negativity Bias in Evaluative Categorizations

Tiffany A. Ito, Jeff T. Larsen, N. Kyle Smith, and John T. Cacioppo
Ohio State University

Negative information tends to influence evaluations more strongly than comparably extreme positive information. To test whether this negativity bias operates at the evaluative categorization stage, the authors recorded event-related brain potentials (ERPs), which are more sensitive to the evaluative categorization than the response output stage, as participants viewed positive, negative, and neutral pictures. Results revealed larger amplitude late positive brain potentials during the evaluative categorization of (a) positive and negative stimuli as compared with neutral stimuli and (b) negative as compared with positive stimuli, even though both were equally probable, evaluatively extreme, and arousing. These results provide support for the hypothesis that the negativity bias in affective processing occurs as early as the initial categorization into valence classes.

Quality definitions

- Transcendent
  - You cannot define quality but you know when you can see it
- Product-based
  - Rely on measurable quantities
- User-based
  - Fitness for use; quality is in the hands of the beholder
- Manufacturing based
  - Conformance to requirements
- Value-based
  - Balance between conformance or performance and an acceptable price

Customer Satisfaction

- All customers want to be satisfied.
- Customer loyalty is only due to the lack of a better alternative
- Giving customers some extra value will *delight* them by exceeding their expectations and insure their return

Service quality

- Product quality versus service quality
- Fuzzy specifications
- Managing expectations
- Expectations are complicated!
  - Not what on an average should happen
  - What might, could, will, should or better not happen!!!

Determinants of service quality

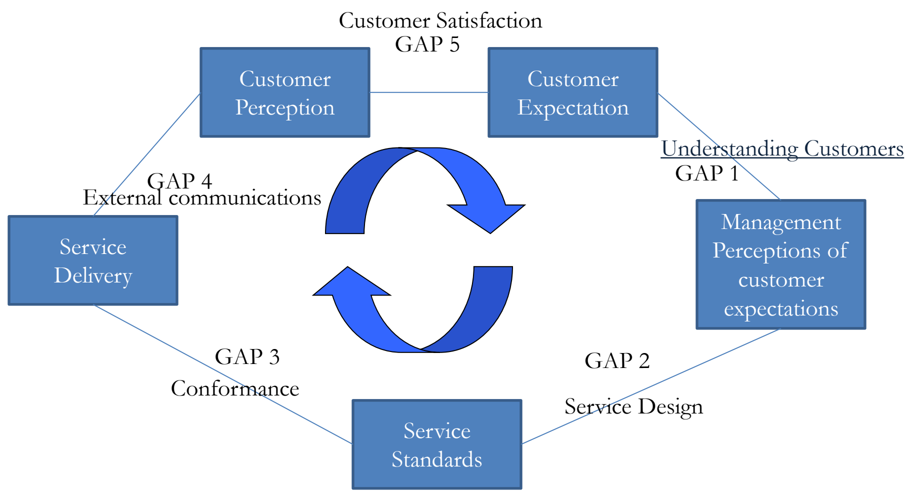
- Reliability
- Responsiveness
- Competence
- Access
- Courtesy
- Communication
- Credibility
- Security
- Understanding/Knowing the customer
- Tangibles

Principle dimensions of Service Quality

- ***R**eliability*: Perform promised service dependably and accurately.
- ***R**esponsiveness*: Willingness to help customers promptly.
- ***A**ssurance*: Ability to convey trust and confidence
- ***E**mpathy*: Ability to be approachable.
- ***T**angibles*: Physical facilities and facilitating goods.

SERVQUAL Form

The Service Quality gap model



STATISTICAL QUALITY CONTROL

Pre-requisites

- Mean and standard deviation
- Random variables and Probability distribution
  - Normal distribution
- Type 1 and Type 2 errors
- Central limit theorem

Opening example

- We promise 40 second response time!
- Average response time at our call center is 40 seconds

Problem with Variability

- Difficult in determining what causes variability in the process
- Quality Inspection in services not feasible
- Need to tease out the impact of assignable causes and **control** the same
- This reduction in variability would make the process **capable**

The process view of services

- Service process are characterized by
  – Output: Service outcome that determines service quality
  – Input: Customer inputs, Resources, employees
  – Variability: Dispersion in output
    - **Natural causes**: Non-controllable; inherent variability in the system, noise, usually minor
    - **Assignable causes**: Controllable, bring about a fundamental change on the nature of the process, causes considerable impact on quality

Process control charts

- Information: Monitor process variability over time
- Control limits: Average + z Normatl variability
  - $z = 3$
- Decision Rule: Ignore variation outside "abnormal"
- Errors: Type 1 and Type 2

Types of Data

- Variable data
  - X-bar and R charts
  - Time, customer satisfaction scores
- Attribute data
  - p-charts and c-charts
  - Good/bad, yes/no, number of errors!

Control Charts

- Different charts have different purposes
- Constructing a control chart
- Knowing when things have gone wrong
- Process capability
- Six sigma!

Constructing a control chart

- Decide what to measure and count
- Collect sample data
- Calculate and plot control limits on the control chart
- Determine if data is in control
- If non-random variation is present, fix the problem and recalculate control limits.

Example: Control Charts for Variable Data

	Ambulance response time (in minutes)						
Sample	1	2	3	4	5	$\bar{X}$	R
1	5.02	5.01	4.94	4.99	4.96		
2	5.01	5.03	5.07	4.95	4.96		
3	4.99	5.00	4.93	4.92	4.99		
4	5.03	4.91	5.01	4.98	4.89		
5	4.95	4.92	5.03	5.05	5.01		
6	4.97	5.06	5.06	4.96	5.03		
7	5.05	5.01	5.10	4.96	4.99		
8	5.09	5.10	5.00	4.99	5.08		
9	5.14	5.10	4.99	5.08	5.09		
10	5.01	4.98	5.08	5.07	4.99		

Constructing A Mean Chart

$$UCL_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R} = 5.01 + (0.58)\,(.115) = 5.08$$

$$LCL_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R} = 5.01 - (0.58)\,(.115) = 4.94$$

where $\bar{\bar{X}}$ = average of sample means = $\Sigma\, \bar{X} / n$

= 50.09 / 10 = 5.01

$\bar{R}$ = average range = Σ R / k

= 1.15 / 10 = .115

Constructing an Range Chart

$UCL_R = D_4 \bar{R} = (2.11)\,(.115) = 2.43$

$LCL_R = D_3 \bar{R} = (0)\,(.115) = 0$

where $\bar{R} = \Sigma R / k = 1.15 / 10 = .115$

k = number of samples = 10

R = range = (largest - smallest)

3σ Control Chart Factors

Sample size	$\bar{X}$-chart	R-chart	
n	**A_2**	**D_3**	**D_4**
2	1.88	0	3.27
3	1.02	0	2.57
4	0.73	0	2.28
5	0.58	0	2.11
6	0.48	0	2.00
7	0.42	0.08	1.92
8	0.37	0.14	1.86

Other charts

- P-charts
  - Calculate percentage defectives in a sample
  - an item is either good or bad
  - Based on binomial distribution

  - p = number defective / sample size, n
  - $\bar{p} = \dfrac{\text{total no. of defectives}}{\text{total no. of sample observations}}$

$$UCL_p = \bar{p} + 3\sqrt{\bar{p}(1-\bar{p})/n}$$

$$LCL_p = \bar{p} - 3\sqrt{\bar{p}(1-\bar{p})/n}$$

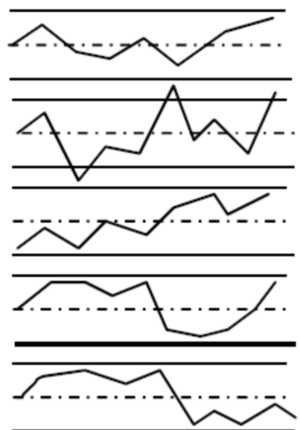
Other charts

- c Charts
  - Count number of defects in an item
  - Based on poisson distribution

  - c = number of defects in an item
  - $\bar{c} = \dfrac{\text{total number of defects}}{\text{number of samples}}$
  -
  - $UCL_c = \bar{c} + 3\sqrt{\bar{c}}$

$$LCL_c = \bar{c} - 3\sqrt{\bar{c}}$$

Performance variation patterns



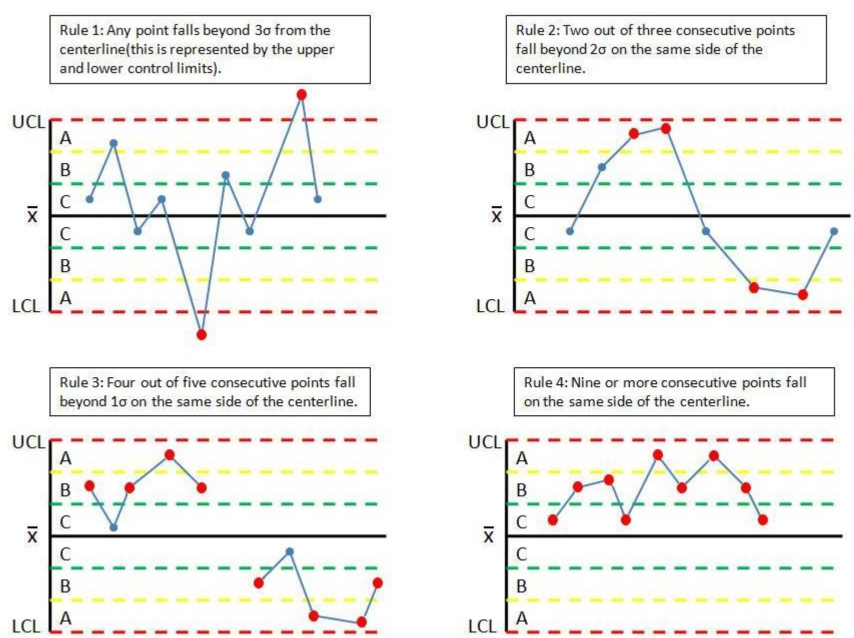
Stable

Unstable

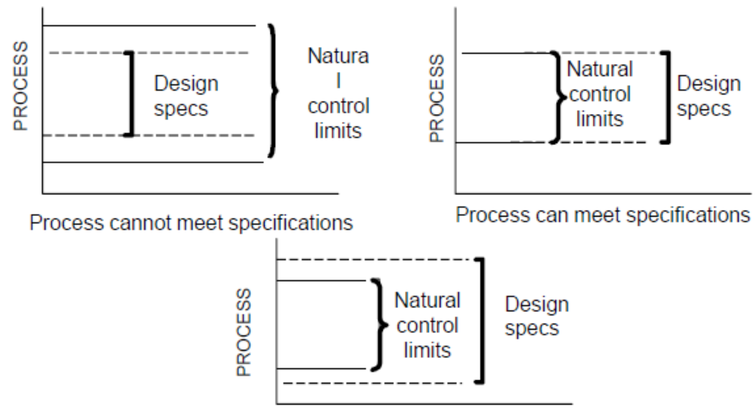
Trend

Cyclical

Shift

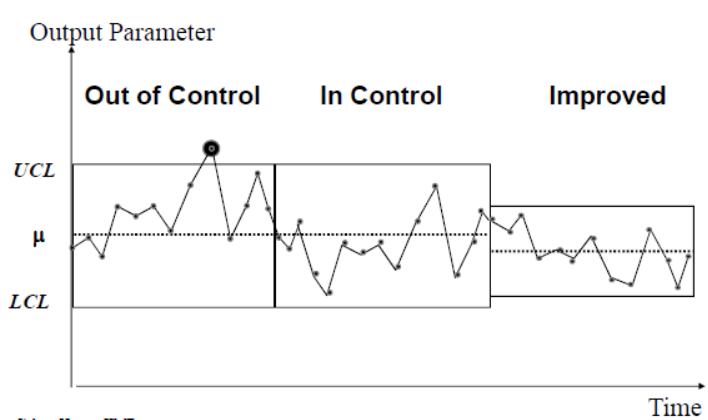


Process capability



09/11/2014 Vinay Kalakbandi 29

From Control to improvement



09/11/2014 Vinay Kalakbandi 30

Sigma statistics

1σ	317 per thousand
2σ	45 per thousand
3σ	2 per thousand
4σ	63 per million
5σ	574 per billion
6σ	2 per billion
7σ	0.3 per billion

Key components of six sigma

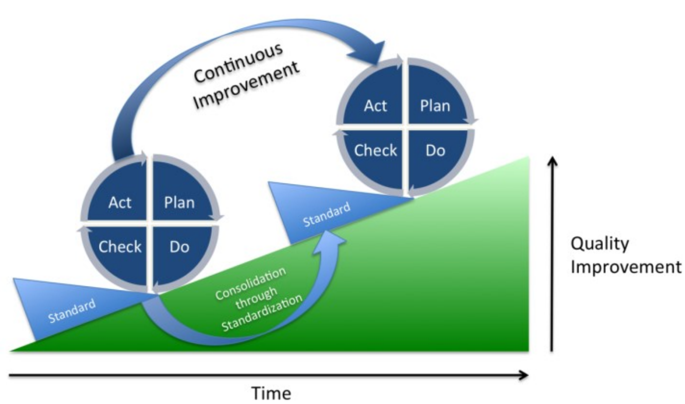
- Management support
- Project based
- Metrics based
- Structured approach
  - Define-Measure-Analyze-Improve-Control
- Tools oriented

The road to six sigma

	Project	Decision	Technical
Define	Team formation, roles and responsibilities, schedule and report	Choose project	Define "as is" process, nominate potential projects
Measure	Define metrics, schedule and report	Gap analysis	Benchmark, baseline
Analyze	Schedule and report	Determine root cause	Evaluate potential causes, get data, analyze relationships
Improve	Schedule and report	Design pilot experiment	Execute pilot experiment
Control	Schedule and report	Set up control scheme	Evaluate control scheme

Quality and Productivity improvement processes

- PDCA cycle



Quality and Productivity improvement processes

- Poka yoke

Quality tools for analysis and problem solving

- 5 whys?
- Statistical Process Control
- Six Sigma
- Quality circles and Kaizen

MANAGING SUPPLY AND DEMAND

________ IS THE ONLY CONSTANT.

Generic strategies

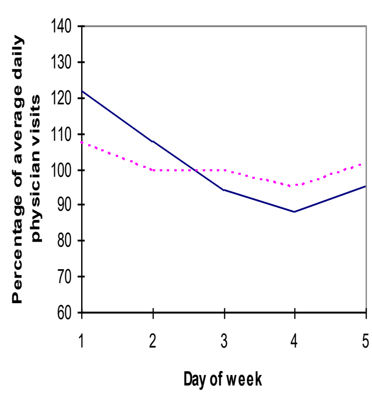
- Level strategy
  - Power stations
  - Managing demand
- Chase
  - Managing supply
  - Call centres

MANAGING DEMAND

Customer induced variability

- Arrival variability
  - Provide generous staffing or require reservations
- Capability variability
  - Adapt to customer skill levels or target customers based on capability
- Request variability
  - Cross-train employees or limit service breadth
- Effort variability
  - Do work for customers or reward increased effort
- Subjective preference variability
  - Diagnose expectations or persuade customers to adjust

Segmenting Demand at a Health Clinic



Smoothing Demand by Appointment Scheduling

Day	Appointments
Monday	84
Tuesday	89
Wednesday	124
Thursday	129
Friday	114

Discriminatory Pricing for Camping

Experience type	Days and weeks of camping season	No. of days	Daily fee
1	Saturdays and Sundays of weeks 10 to 15, plus Dominion Day and civic holidays	14	$6.00
2	Saturdays and Sundays of weeks 3 to 9 and 15 to 19, plus Victoria Day	23	2.50
3	Fridays of weeks 3 to 15, plus all other days of weeks 9 to 15 that are not in experience type 1 or 2	43	0.50
4	Rest of camping season	78	free

EXISTING REVENUE VS PROJECTED REVENUE FROM DISCRIMINATORY PRICING

	Existing flat fee of $2.50		Discriminatory fee	
Experience type	Campsites occupied	Revenue	Campsites occupied (est.)	Revenue
1	5.891	$14,727	5,000	$30,000
2	8,978	22,445	8,500	21,250
3	6,129	15,322	15,500	7.750
4	4,979	12,447	….	….
Total	25,977	$ 64,941	29,000	$59,000

Managing demand

- Promoting off peak demand
- Developing complementary services
- Reservation systems and overbooking

Overbooking

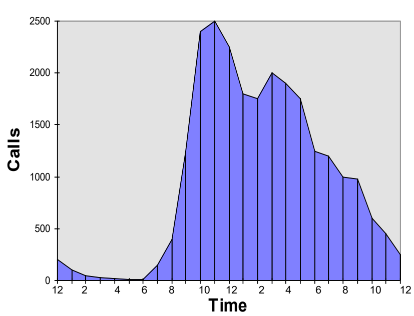
- Need for overbooking
- Fairness concerns
- Pros and cons v/s waitlisting

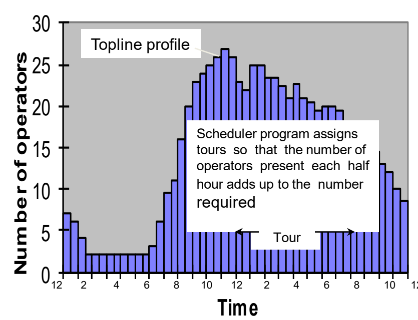
Hotel Overbooking Loss Table

No-shows	Probability	Number of Reservations Overbooked 0	1	2	3	4	5	6	7	8	9
0	.07	0	100	200	300	400	500	600	700	800	900
1	.19	40	0	100	200	300	400	500	600	700	800
2	.22	80	40	0	100	200	300	400	500	600	700
3	.16	120	80	40	0	100	200	300	400	500	600
4	.12	160	120	80	40	0	100	200	300	400	500
5	.10	200	160	120	80	40	0	100	200	300	400
6	.07	240	200	160	120	80	40	0	100	200	300
7	.04	280	240	200	160	120	80	40	0	100	200
8	.02	320	280	240	200	160	120	80	40	0	100
9	.01	360	320	280	240	200	160	120	80	40	0
Expected	loss, $	121.60	91.40	87.80	115.00	164.60	231.00	311.40	401.60	497.40	560.00

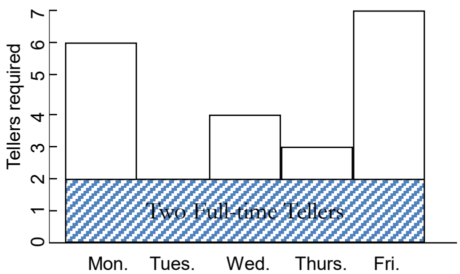
MANAGING SUPPLY

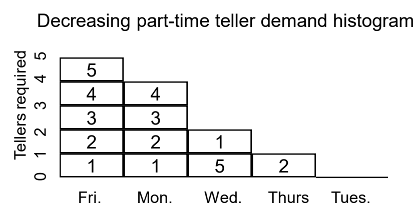
Daily Scheduling of Telephone Operator Workshifts





Scheduling Part-time Bank Tellers





DAILY PART-TIME WORK SCHEDULE, X=workday

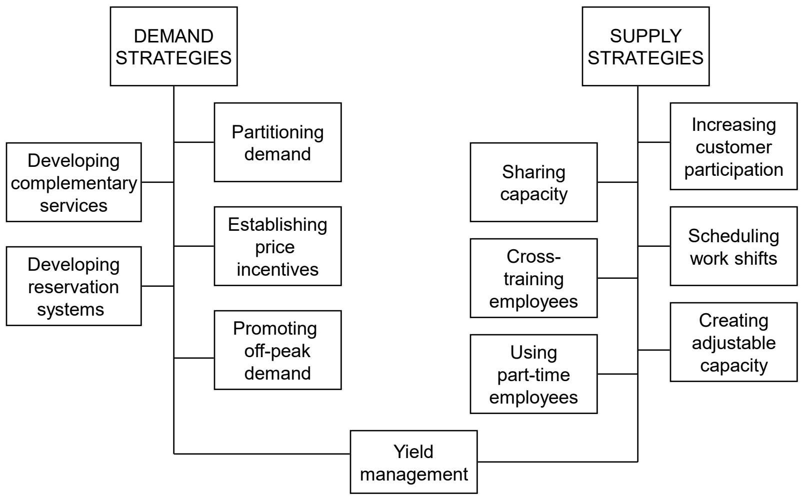
Teller	Mon.	Tues.	Wed.	Thurs.	Fri.
1	x	….	x	….	x
2	x	….	….	x	x
3,4	x	….	….	….	x
5	….	….	x	….	x

Managing supply

- Increasing customer participation
- Creating adjustable capacity
- Sharing capacity
- Cross training employees
  – Using part time employees

09/11/2014 Vinay Kalakbandi 50

Strategies for Managing Demand



Yield Management

- "Selling the right capacity
  to the right customer at the right price"
- Business Requirements
  - Limited Fixed Capacity
  - Business environment where YM can help
    - Ability to segment markets
    - Perishable inventory
    - Advance sales
    - Fluctuating demand
    - Accurate, detailed information systems

Industries that Fully Use YM Techniques

- Transportation-oriented industries
  - Airlines
  - Railroads
  - Car rental agencies
  - Shipping
- Vacation-oriented industries
  - Tour operators
  - Cruise ships
  - Resorts
- Hotels, medical, broadcasting

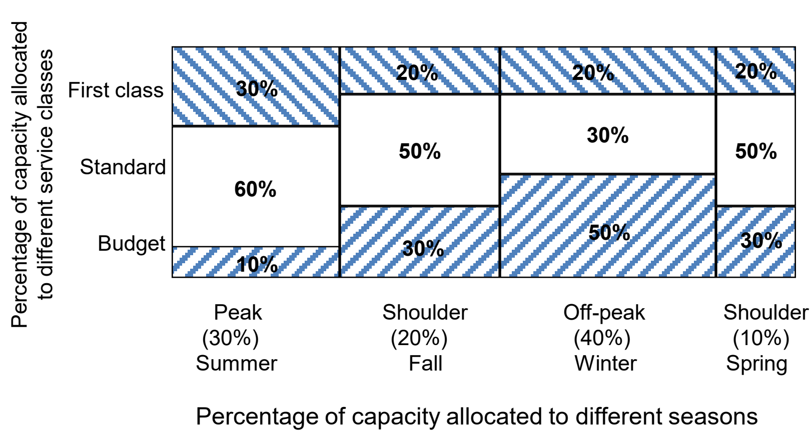
Elements of a Yield Management System

- Lingo
  - Reservation prices – Price discrimination
  - Fare Buckets – For capturing consumer surplus
  - Protection level – for better managing the yield
  - Nesting in capacity allocation
- Littlewood's rule
- EMSR a and EMSRb

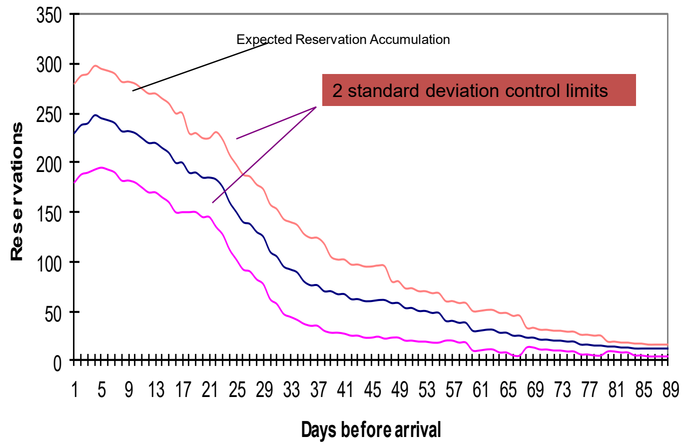
Four Types of Fares

Fare Type:	BUSINESS	COACH	DISCOUNT	PROMOTION
Prices:	250-140%	140%-70%	60%-30%	40%-25%
Letter codes:	F, C, J	Y	H, Q, M	K, V
Commissions:	10%-30%	10%-15%	10%-15%	0%-10%
Seat size:	BIG	small	small	small
Service:	high	normal	normal	normal
Early Purchase?	0 days	0 days	14-30 days	30-60 days
Refundable?	yes	yes	partial	no
Min. Stay?	no	no	7-14 days	7-14 days
Days "full":	under 5%	under 5%	5%-50%	20%-80%
Typical user:	business	business	holiday	group
Elasticity:	-0.5	-0.7	-1.4	-2.0

Seasonal Allocation of Rooms by Service Class for Resort Hotel



Demand Control Chart for a Hotel



Considerations while devising fare structures

- Dilution
- Displacement
- Share-shift
- Stimulation

American Airlines case

THANK YOU