Yield Management (OM) Introduction

Ing.J.Skorkovský, CSc,
Department of Business Management
FACULTY OF ECONOMICS AND ADMINISTRATION
Masaryk University Brno
Czech Republic

Yield Management (YM)-definition I.

- YM seeks to maximize yield or profit from

  Time-sensitive products and services
- Used in industries with flexible and expensive capacities, perishable products (fresh fish, flowers, bakery products) and uncertain demand.
- It is part of revenue management
- **Type of problems**:
  - overbooking (airlines, hotel industry,..)
  - partitioning demand into fare classes
  - single order quantities

YIELD: to produce or furnish (payment, profit, or interest): a trust fund that yields ten percent interest annually; that investment will yield a handsome return.

Yield Management (YM)-definition II.

- Simply put, the purpose of **Yield Management** is to achieve **maximum revenue/profit**.
- To get **Max Revenue/Profit**, a **yield management** strategy needs to be both **reflective** and **forward-looking**.
- Yield managers should attain a clear and detailed understanding of what has happened **before** and what is happening **now.**
- The most efficient way to do this is to draw from historical data to predict what may happen in the future.
- So, the process of effective yield management involves understanding, anticipating, and reacting to consumer behavior (to maximize revenue ultimately).

Single Order Quantity

The single order is concerned with the planning and control of inventory items that are either purchased only once during a time period or for only one production run. The familiar inventory models (EOQ, EOI, and EPQ) do not readily apply to the single order because (1) demand is not a continuous event (2) the demand level may change drastically from time period to time period, or (3) the product's market life may be very short due to obsolescence or perishability. The single order quantity problem is frequently referred to in the literature as the Christmas tree problem or the newsboy problem.

Newsboy problem – see next slide and slide number 11 as well !!!

Economic Order Interval: period between orders that minimizes the total inventory cost under the given assumptions.
EOI is estimated by comparing the **cost of placing an order** with the **cost of holding inventory**.

EPQ =**Economic production quantity** model (also known as the **EPQ model**) determines the quantity a company or retailer should order to minimize the total inventory costs by balancing the inventory holding cost and average fixed ordering cost.

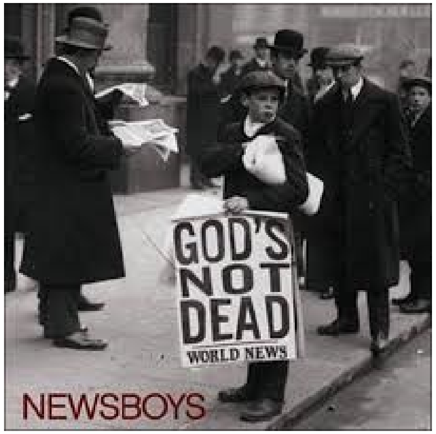
Newsboy problem

Often managers have to make decisions about **inventory level** over a very limited period. This is the case, for example with seasonal goods such as Christmas cards that should satisfy all demand in December, but any cards left in January have almost no value.

These single-period decision models are phrased as the **Newsboy Problem**. For a newsboy who sells papers on a street corner, the demand is uncertain, and the newsboy must decide how many papers to buy from his supplier.

If he buys too many papers, he is left with unsold papers that have no value at the end of the day.

If he buys too few papers, he has lost the opportunity of making a higher profit.

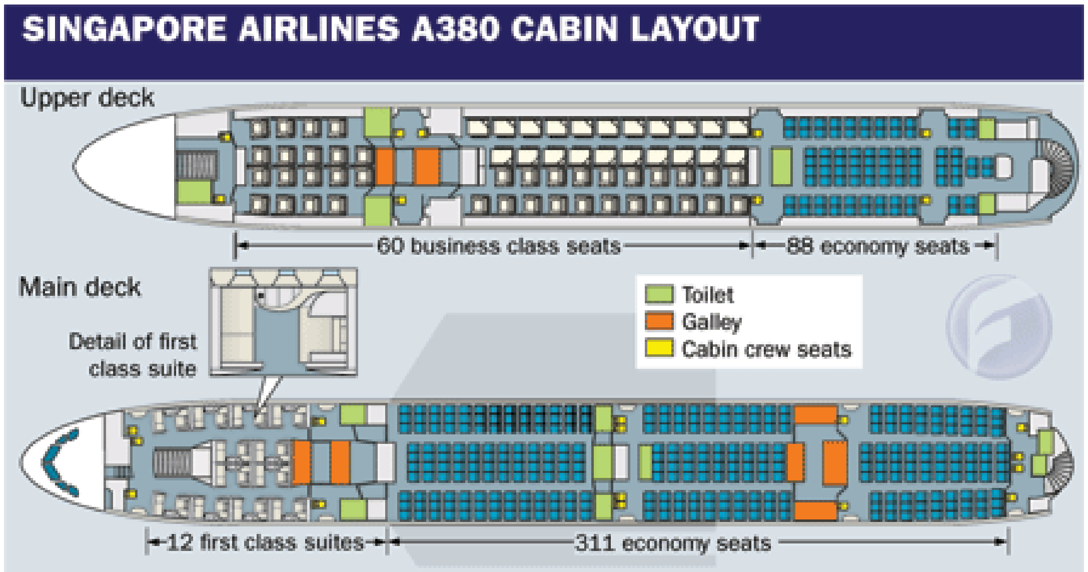


Prices and demand

- Prices can be determined by:
  - Service
  - Group of services
  - Market (consumer type or geographical area) or
  - A combination of the above

- And the demand side is characterized with:
  - Variability of demand
  - Variability of value (time, area, type of client, type of service)

Overbooking (hotels, airlines,..) - example



7 % out of 311=22

10%-30 % of a **no-show** (traveler who reserved ticket, but canceled it at the last minute). Therefore, airline companies **overbook** their capacities. The **no-show** ratio is sometimes lower than the **overbooking ratio**, so „bumped“ client will be compensated by providing the free of charge service at another time or place. They are so-called „**offloaded**“ to other routes.

Example:

311 economy seats, estimation of 10 % no-show-> **31** places would be lost (only 280 seats occupied). If overbooked by 10 % (31 more tickets offered) and no-show ratio on reality is only 7 %->only 22 clients cancelled - > 311-22=289 seats occupied ->289 + **31**=320->320-311=**9** clients have to be „bumped“ (or 31-22=9) and provided by free air tickets, which is better than the loss of not sold 31 places.

You have to calculate the loss of 31 places -22 sold tickets =amount which must cover expenses for 9 bumped clients

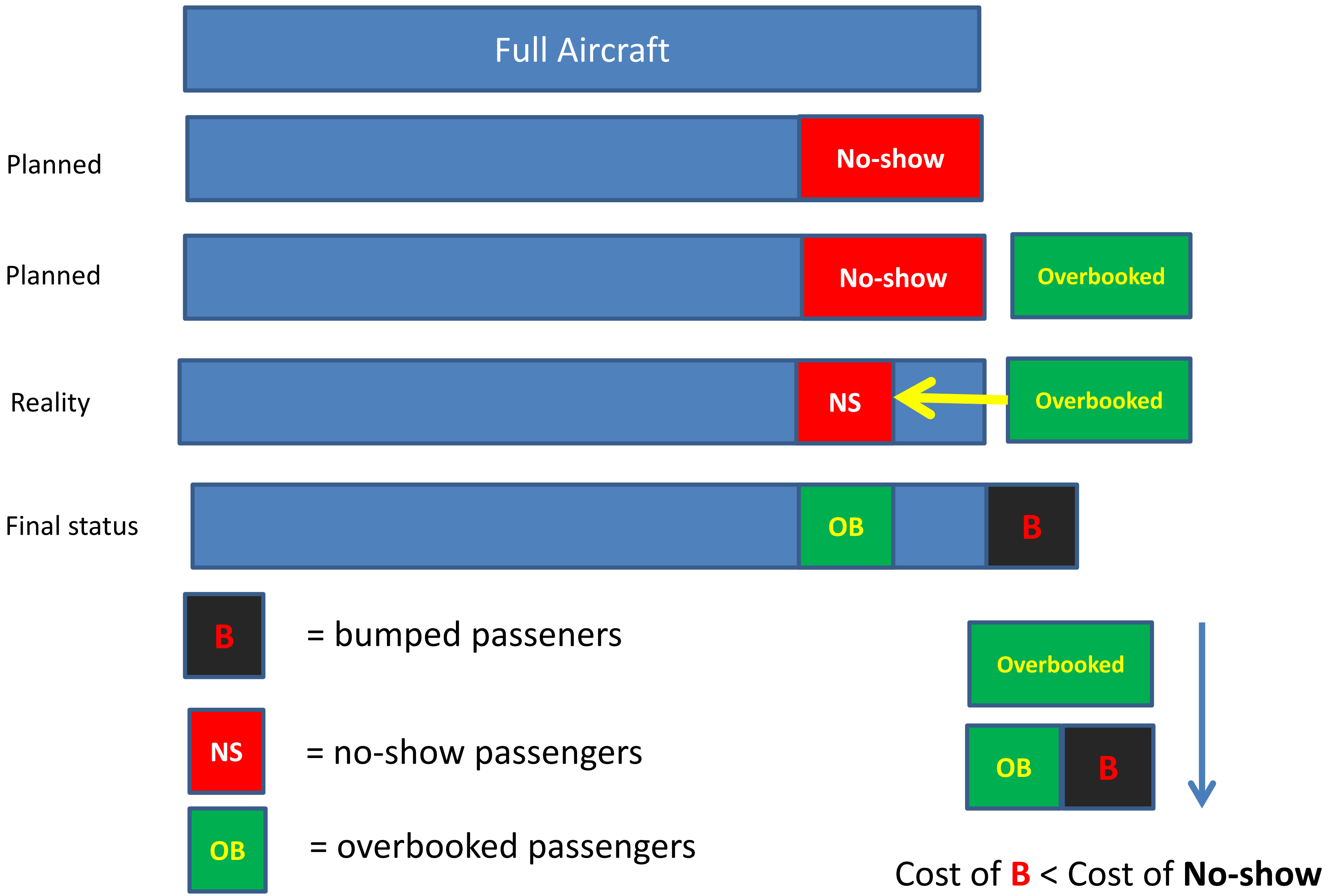
Basic calculations - example

- Air ticket in economy class =10000
- 31 no-show = loss = **310 000**= 31*10000
- 9 bumped travellers – granted business class instead of economy class ->one air ticket =30000
- Cost of bumping = 270 000 =9*30000
- Difference = **310000**-270000 = 40000 profit

Economy

Business Class

Overbooking<->No-Show



Overbooking - claims

- Do not settle! Do not worry about it! Instead get up to €600 + luxury hotel + meals + additional expenses + wellness + new ticket + stay in the airport lounges!

Delta Air Lines has increased the amounts passengers can be offered to give up their seats to up to almost US$10,000 in extreme cases — something passengers can take advantage of if they act in collusion (secret deal).

Single order quantities

- Newspapers
- Magazines
- Florists
- Bakeries
- Fresh fishes

Single order quantities (home study)

- **N** = number of items that can be sold (estimated optimum)
- **X** = number of items ordered by Salesman
- C_0 = **Cost** of **over-estimating** demand (**cost of remaining faded flowers and are not sold**)
- C_u = Cost of **under-estimating** demand (**customers like to buy more roses and you do not have enough of them**)
- **Cu** >= **C**$_0$
- P(N<X) = probability of **over-estimating** demand or no-show
- P(X<=N)= probability of **under-estimating** demand or no-show

$P(X<=N)*C_u$ **>=** $P(N<X)*C_0$

↓ P(X<=N) +P(N< X) =1 -> P(X<=N) = 1-P(N<X)

$(1-P(N<X))*C_u$ >= $P(N<X) * C_0$ -> **OPTIMUM PROBABILITY**

$$\mathbf{P(N<X)} \le \frac{Cu}{Cu + C_0}$$

Final formula for over-estimating demand

(1-p)*Cu>=pCo
Cu+pCu >=pCo
Cu>=>p(Cu+Co)

Las Vegas hotel (Bellagio)

Manager Simon Stein

Po<= Cu/(Cu+Co)

Example 1 ->Single Order Quantity -hotel industry

Manager Simon Stein of the **Bellagio** in Las Vegas is tired of customers who make reservation and **do not show up**. Rooms rent is **100** USD per night and cost **25** USD to maintain per day.

Overflow („bumped“) customers can be sent to **Motel 7** for only **70** USD per night.

Simon´s records of no-show over past six months are given below. Should Bellagio start overbooking? If so, how many rooms should be overbooked?

No-Show	Probability
0	0,15
1	0,25
2	0,30
[redacted]	0,30

Simon Stein statistics

Solution : C_0 = **70** USD - cost of overestimating demand

C_u = **100** USD-**25** USD =75 USD - cost of underestimating demand

$$P(N<X) <= \frac{Cu}{Cu + C_0} = 75/(75+70)=75/145 = \mathbf{0{,}517}$$

No-Show	Probability	P(N<X)
0	0,15	0,00
1	0,25	0,15
2	0,30	0,40
3	0,30	0,70

0,15+0,25=0,40 and 0,40+0,30=0,70...

Probabilities are cumulating and choice in 0,40->0,517
Optimal probability of no-show falls between
0,40 and 0,70. So if we take less of equal to 0,517,
so next lower value is 0,40. **So two rooms have to be overbooked !!!**

Example 2 ->Single Order Quantity - Airlines (home study)

- **FlyUS** Airlines is unhappy with the number of empty seats (same with hotel rooms) on its NY-Miami flights. To remedy the problem, the airline is offering a special discounted rate of **89** USD instead of standard full fare **169** USD, but only for 7-days advance purchases and for a limited number of seats per flight. The aircraft flown from **NY** to **Miami** holds max **100** passengers. Last month´s distribution of full-fare passengers is shown below. How many seats **FlyUS** reserve for full–fare passengers ?

Aircraft capacity			100	
Full fare	No-Show	Frequency	Probability	P(N<X)
50	50	15	0,15	0,00
55	45	20	0,20	0,15
60	40	35	0,35	0,35
65	35	20	0,20	0,55
70	30	10	0,10	0,65

100= 50+50 = 55+45=60+40=65+35=70+30 (the number of passengers)

Cu = 169-89=80,Co =89

P(N<X) <=Cu/(Cu+Co)=80/169=**0,473**

So 60 full-fare passengers have to be reserved