



Introduction to MIS

Data and Competitive Advantage

Learning Objectives

- May need to review Access lessons and examples from MIS 153 class
- Define a database and a database management system
- Explain logical database design and the relational database model
- Define the components of a database management system
- Summarize recent trends in database design and use
- Explain the components and functions of a data warehouse
- Describe the functions of a data mart
- Define business analytics and describe its role in the decision-making process
- Explain big data and its business applications
- Explain database marketing and its business applications

Forrester Research of HR Professionals - 2018

Six Top Digital Age Skills



Yahoo Finance - 2019

RECESSION-PROOF INDUSTRIES AND JOBS, BY MEDIAN PAY

RECESSION-PROOF INDUSTRY

Job Title

OVERALL MEDIAN PAY

CLOUD COMPUTING

Information Technology (IT) Architect

\$126K

ARTIFICIAL INTELLIGENCE (AI)

Software Developer

\$83.7K

BIG DATA ANALYTICS

Data Scientist

\$99.1K

CYBER SECURITY

Cyber Security Analyst

\$76K

DIGITAL MARKETING

Marketing Manager

\$66.2K

SOURCE: PAYSACLE

YAHOO!
FINANCE



Difficulties of Managing Data

- **Amount of business data increases exponentially**
 - **Now includes Web and social media data**
- An ever-increasing amount of data needs to be considered in making organizational decisions, especially marketing decisions
- Data are scattered and collected by many individuals using various methods and devices
- Data come from many sources including internal sources, personal sources, and external sources
- **Data confidentiality, availability, accessibility, and integrity are critical concerns**

Web Data

- **Clickstream** - Data that visitors and customers produce when they visit a Website
- **Social Media** – tweets, likes, etc.
- **Web of Things** – Data from machines, sensors, and appliances hooked into web
 - Cell phones & PDA's
 - Mote sensors
 - Automobiles
 - Appliances
 - Security devices



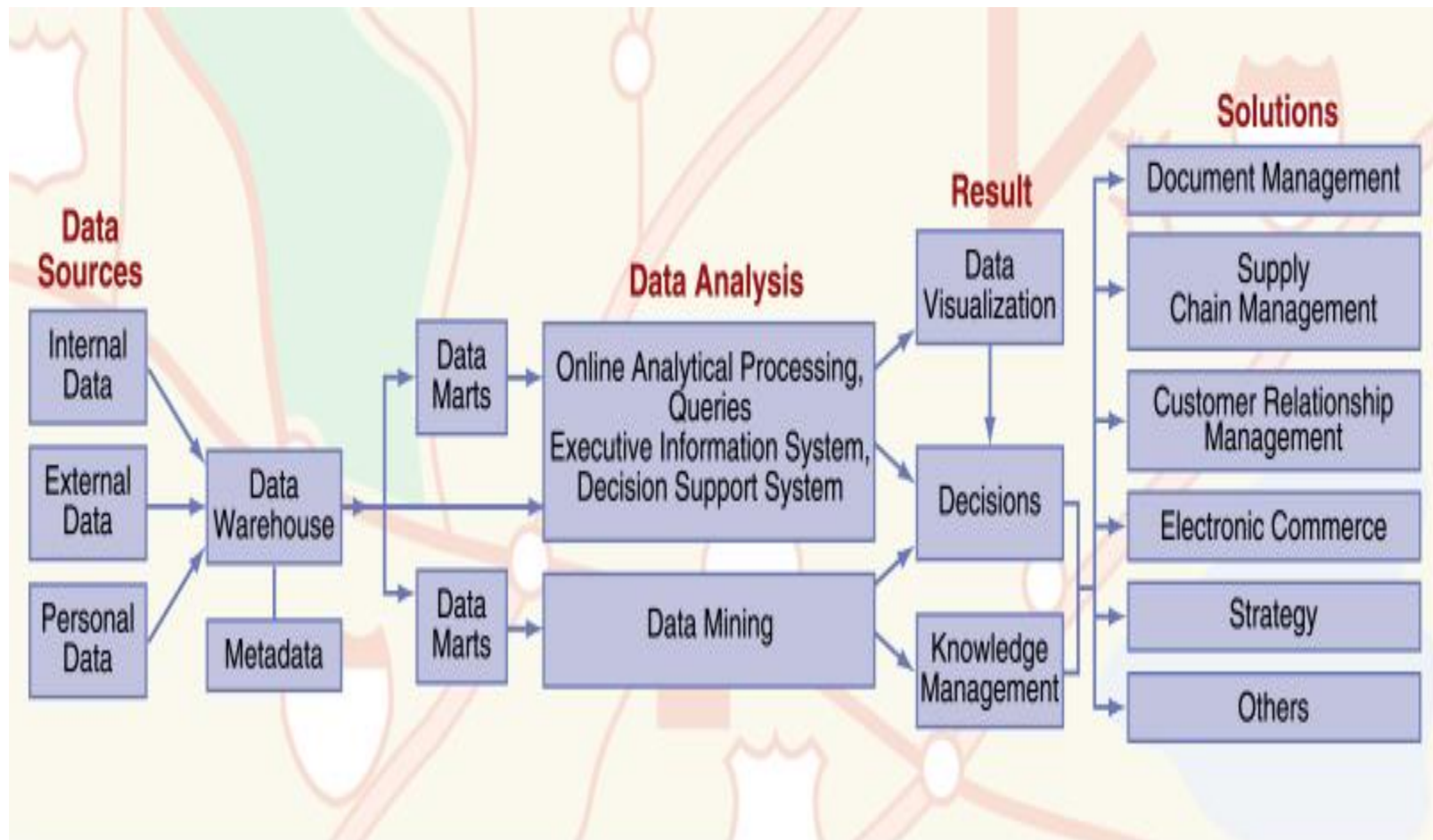


Data Organizational Hierarchy



- **Bit** (a binary digit): a circuit (or other electro-mechanical state) that is either on or off
- **Byte**: group of 8 bits, represents a single character
- **Field**: name, number, or characters that describe an aspect of a business object or transaction
- **Record**: collection of related data fields
- **File (or table)**: collection of related records
- **Database**: a collection of integrated and related tables
- **Data Warehouse**: Summary data from multiple databases

Data Life Cycle in Modern Organizations

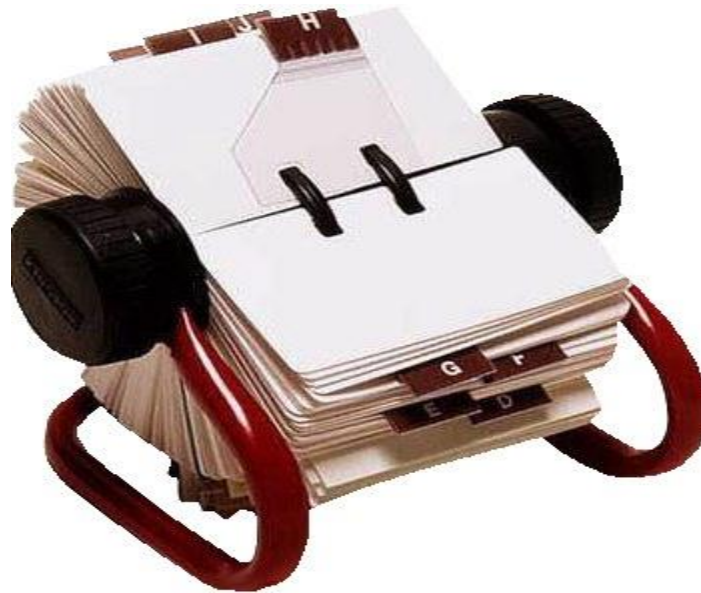


Basic Data Example

*Interrelated
Data – Customers
are related to jobs
and to sources
(and vice versa)*

- Customer
 - Customer ID
 - Name
 - Address
 - Source ID
- Job
 - Job ID
 - Date
 - Description
 - Amount
 - Customer ID
- Source
 - Source ID
 - Name

- If you had only rolodex or index cards to store this information on, how would you arrange it ?





Don't look ahead !

Representation of Information

- Index cards
 - A card for each customer, showing his ID (or name) at the top and other info on body of card
 - Arrange cards in some physical order (name, number, ...)
 - Some tabs at key numerical (or alphabetical points)
 - Another box or group of cards for jobs, and another for sources
- Each set of index cards can only have one physical arrangement

- If you had a spreadsheet program (i.e. Excel), how would you set up this data ?

F16		f(x)	Σ	=		
	A	B	C	D	E	F
1						
2						
3	<u>Date</u>	<u>Start time</u>	<u>End time</u>	<u>Pause</u>	<u>Sum</u>	<u>Comment</u>
4	2007-05-07	9,25	10,25	0		1 Task 1
5	2007-05-07	10,75	12,50	0	1,75	Task 1
6	2007-05-07	18,00	19,00	0		1 Task 2
7	2007-05-08	9,25	10,25	0		1 Task 2
8	2007-05-08	14,50	15,50	0		1 Task 3
9	2007-05-08	8,75	9,25	0	0,5	Task 3
10	2007-05-14	21,75	22,25	0	0,5	Task 3
11	2007-05-14	22,50	23,00	0	0,5	Task 3
12	2007-05-15	11,75	12,75	0		1 Task 3
13						
14						
15						
16						
17						
18						



Don't look ahead !

■ Spreadsheet tables

- A row of a spreadsheet for each customer
- A column for each type of data
- Another spreadsheet for jobs
- Another spreadsheet for contacts

Customer Table/Spreadsheet

<u>ID</u>	<u>Name</u>	<u>Address</u>	<u>Source ID</u>
3	Jones, Ed	11 Apple St. Memphis, TN	45
7	Smith, Jane	102 First Ave. Jackson, TN	92
2	Adams, Tom	2102 9'th St. Little Rock, AR	4

- When is a database (i.e. Access) more appropriate than a spreadsheet for a problem ?





Don't look ahead !

Spreadsheets vs Databases

- Spreadsheet (i.e. Excel)
 - smaller amounts of data
 - little relationships among data
- Data (i.e. Access)
 - a lot of data
 - relationships between tables

Database Approach



- ***Database management system (DBMS)***
provides all users with access to all the data
- **DBMSs** **minimizes** the following problems:
 - ***Data redundancy***: the same data stored in many places
 - ***Data isolation***: applications cannot access data associated with other applications
 - ***Data inconsistency***: various copies of the data do not agree

Database Approach (Continued)

- DBMSs **maximize** the following issues:
 - ***Data security and privacy (access control – who can have what kind of access to what data)***
 - ***Data integrity:*** data meets certain constraints, no alphabetic characters in zip code field
 - ***Data independence:*** applications and data are independent of one another, all applications are able to access the same data

Methods for Accessing Data

■ Sequential access file structure

- Records in files are organized and processed in numerical or sequential order
- Records are organized based on a primary key (e.g., Social Security numbers or account numbers)
- Today primarily **used for backup** and archive files because they rarely need updating



Methods for Accessing Data (con't)

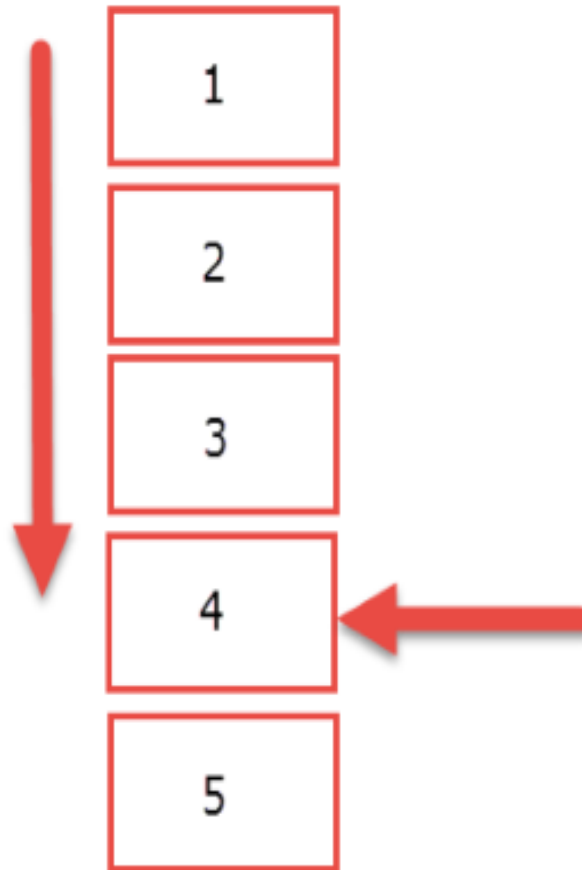
■ Random access file structure

- Records can be accessed in any order, regardless of their physical locations in storage media
- Fast and very effective when a small number of records need to be processed daily or weekly
- Records are stored on magnetic disks to achieve speed



Sequential vs Random Access

With **sequential access**, elements #1,2, 3 must be processed before element #4 can be processed.

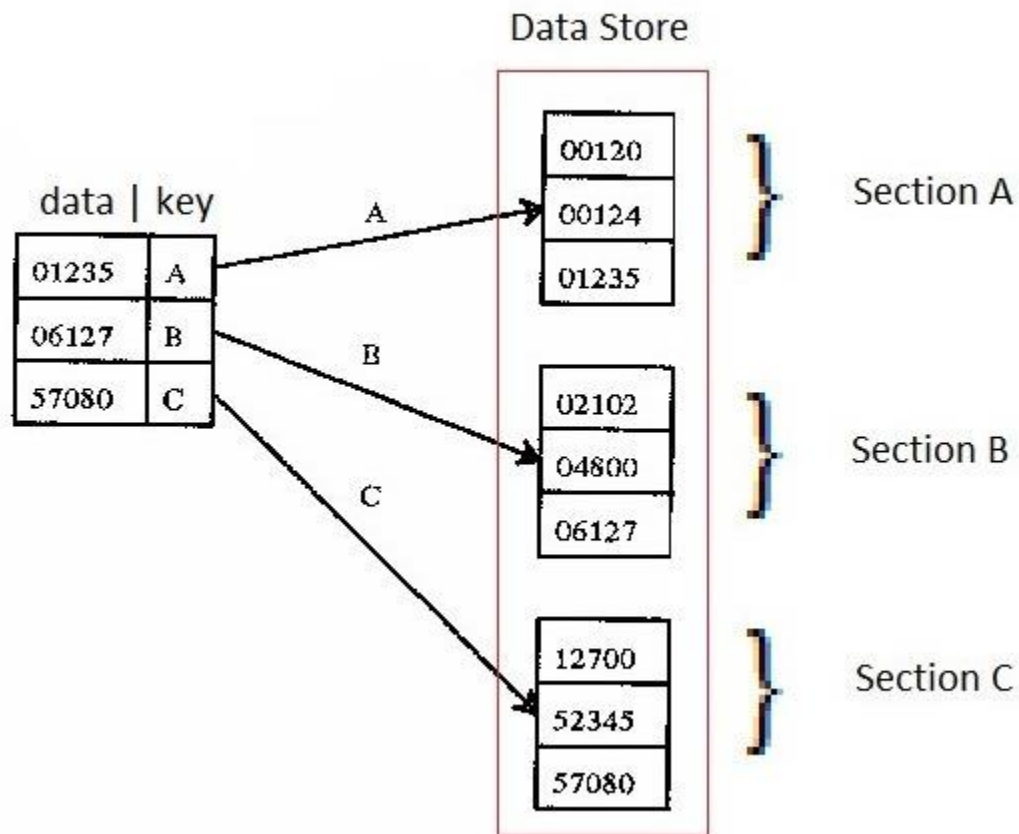


With **direct access**, element #4 in the list can be accessed without having to process the elements before it.

Methods for Accessing Data (con't)

- **Indexed sequential access method (ISAM)**
 - Records accessed sequentially or randomly, depending on the number accessed
 - Random access: used for a small number
 - Sequential access: used for a large number
 - Uses an **index structure** and has two parts
 - Indexed value
 - Pointer to the disk location of the record matching the indexed value
- Modern improvements to ISAM such as B-tree (balanced trees)

ISAM (con't)



Early Database Design Models

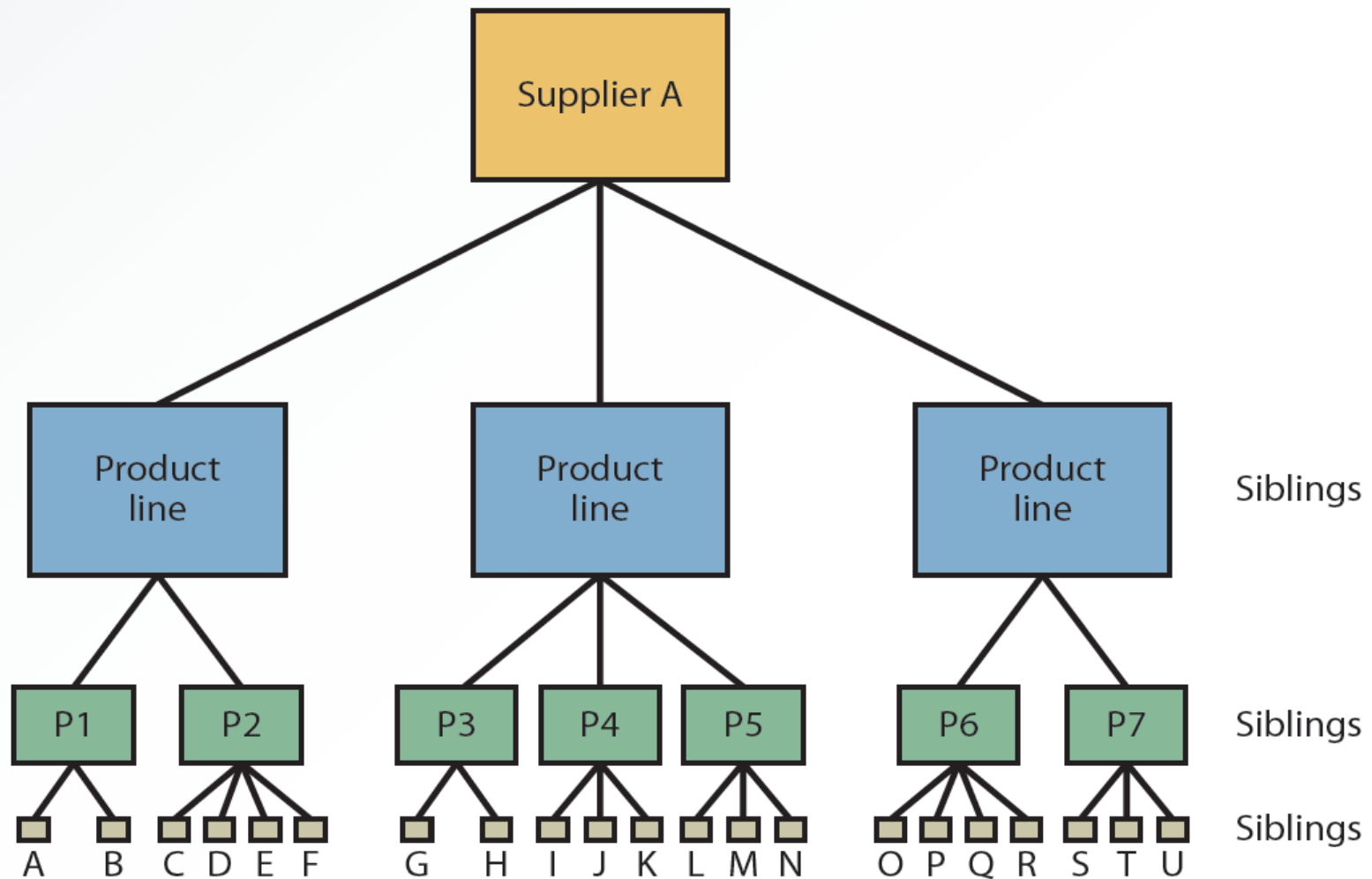
- **Hierarchical** model

- Relationships between records form a treelike structure
- Records are called nodes, and relationships between records are called branches

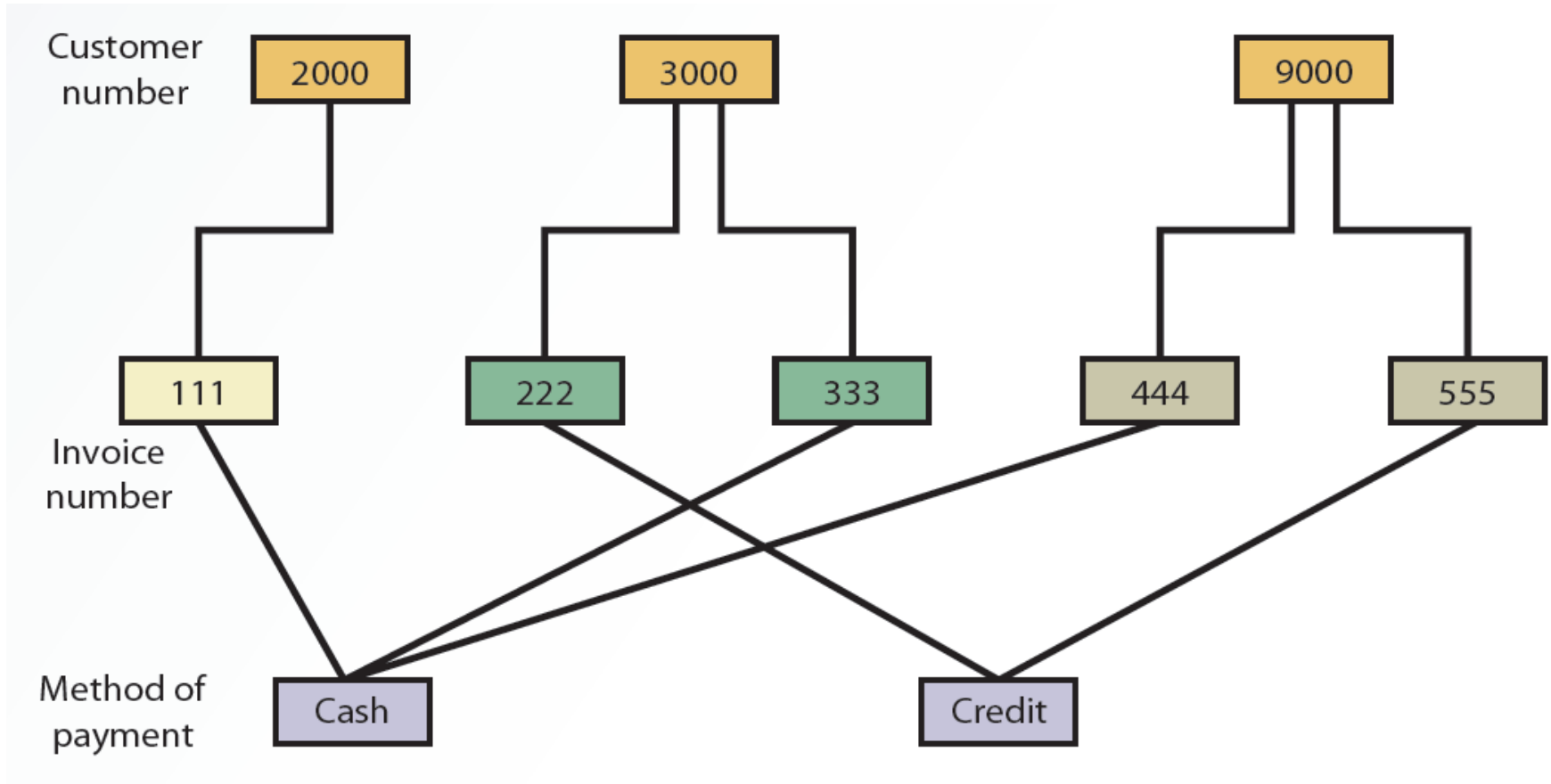
- **Network** model

- Similar to the hierarchical model but records are organized differently (sets)
- Each record can have multiple parent and child records

Hierarchical Model



Network Model (multiple trees)



The Relational Model

- Uses a two-dimensional table of rows and columns of data
 - Rows are records (i.e., tuples)
 - Columns are fields (i.e., attributes)
- **Data dictionary**
 - “Data about data” - such as data types for fields, default values, and validation rules for data in each field
- **Primary key**
 - Uniquely identifies every record in a relational table
- **Foreign key**
 - Field in a relational table that matches the primary key column of another table
 - Used to cross-reference (relate) tables

What's Wrong With This Arrangement ?

Student Name	Student Phone	Advisor Name	Advisor Phone
Baker,Rex	232-8897	Parks	236-0098
Charles,Mary	232-0099	Parks	236-0098
Johnson,Beth	232-4498	Jones	236-0110
Scott,Glenn	232-4444	Parks	236-0098
Zylog,Frita	232-5588	Jones	236-0110



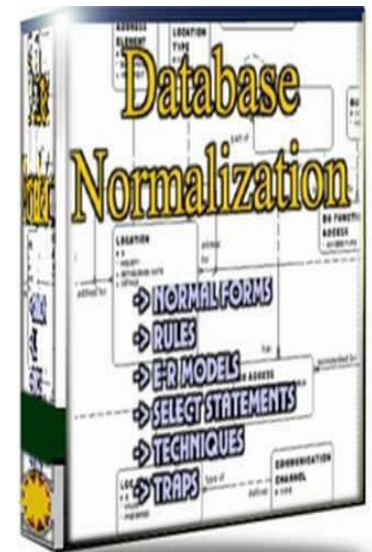
Don't look ahead !

Data Arrangement (con't)

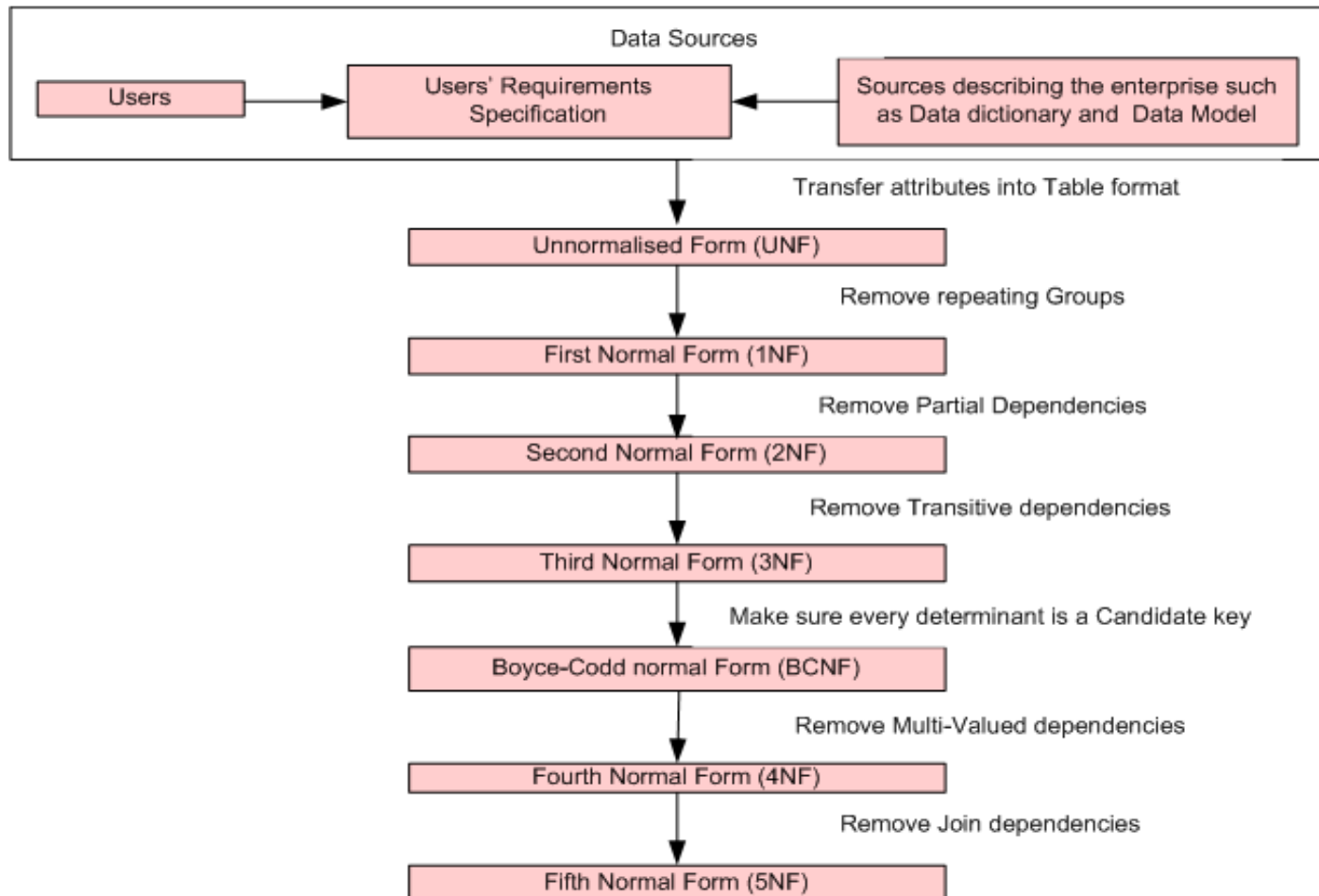
- Duplicate info (multiple copies of an advisor's name and phone)
- Have to make changes more than one place to change an advisor's phone number
- Loose advisor data, if delete last student with that advisor

Normalization

- **Normalization** is a method for analyzing and reducing a relational database to its most streamlined form for:
 - Minimum redundancy
 - Maximum data integrity
 - Best processing performance
- *Normalized* data is when attributes in the table depend only on the primary key (**one normalization form**)



Normal Forms



“Normalized” Arrangement [2 tables]

Student Name	Student Number	Advisor
Baker, Rex	232-8897	Parks
Charles, Mary	232-0099	Parks
Johnson, Beth	232-4487	Jones
Scott, Glenn	232-4444	Parks
zylog, Frita	232-5588	Jones

Advisor Table

Advisor Name

Advisor Phone

Parks

236-0098

Jones

236-0110

“Normalized” Arrangement (con’t)

- Easier to maintain (i.e. change advisor phone)
- Less susceptible to “anomalies”
 - Loosing advisor data
 - Adding advisor without students yet
- However, need to *join* tables to produce some reports

Spreadsheet Representation

Problems Maintaining this Data ?

Item Number ▾	Description ▾	Item Type ▾	On Hand ▾	Wholesale ▾	Supplier Code ▾	Supplier Name ▾	Phone ▾
3673	Cotton Visor	Cap	145	\$4.59	LM	Last Merchants	803-555-7641
6234	Foam Visor	Cap	225	\$0.79	LM	Last Merchants	803-555-7641
7363	Baseball Cap	Cap	105	\$4.87	LM	Last Merchants	803-555-7641
8344	V-Neck Pullover	Clothing	76	\$13.60	LM	Last Merchants	803-555-7641
8590	V-Neck Vest	Clothing	65	\$20.85	LM	Last Merchants	803-555-7641
4543	Crew Sweatshirt	Clothing	90	\$7.29	PC	PJPratt Clothing	517-555-3853
6185	Fleece Vest	Clothing	45	\$28.80	PC	PJPratt Clothing	517-555-3853
6345	Golf Shirt	Clothing	125	\$10.06	PC	PJPratt Clothing	517-555-3853
8206	Turtleneck	Clothing	55	\$11.29	PC	PJPratt Clothing	517-555-3853
9458	Windbreaker	Clothing	54	\$15.17	PC	PJPratt Clothing	517-555-3853
9583	Crew T-Shirt	Clothing	125	\$2.81	PC	PJPratt Clothing	517-555-3853
5923	Drink Holder	Novelty	80	\$0.82	SD	Script Distributors	610-555-8741
6523	Mouse Pad	Novelty	150	\$1.29	SD	Script Distributors	610-555-8741
6974	Pen	Novelty	225	\$0.49	SD	Script Distributors	610-555-8741
7123	Sports Bottle	Novelty	150	\$1.04	SD	Script Distributors	610-555-8741
7934	Tote Bag	Novelty	225	\$1.26	SD	Script Distributors	610-555-8741
8136	Travel Mug	Novelty	80	\$2.47	SD	Script Distributors	610-555-8741

Table Keys

- A table has only one **primary key**
 - The primary key is one or more fields that uniquely identify each record (row) in the table
- A table have none, one, or more **foreign keys**
 - A foreign key is one or more fields that are the primary key in another table
 - Foreign keys are used to relate the entities (tables) in a relational database
- **Relationships** represent a connection of some type (physical or virtual) between entities

Designing the Database

- Building a database with only 2 tables is easy
- Modern business databases may have hundreds of tables
- **Data model:** Diagram that represents the entities in the database and their relationships:
 - **Entity** is a person, place, thing or event
 - **Attribute** (or property) is a characteristic or quality of a particular entity
 - **Primary key** is a field that uniquely identifies that record
 - **Foreign keys** are fields in one table that are primary keys of another – they are used to “relate” tables together

Entity-Relationship Modeling



- Database designers plan the database design in a process called **entity-relationship (ER) modeling**
- **ER diagrams** consists of entities, attributes and relationships
- **Entities are things about which we gather data; i.e. STUDENT**
- Attributes are the specific data we which to maintain for an entity
- Relationships represent a connection of some type (physical or virtual) between entities; they are bi-directional, and each direction has a minimum and maximum cardinality

SALESPERSON - ORDER Relationship

- Direction 1 - Each salesperson can have none or many orders
 - maximum cardinality: N (many)
 - minimum cardinality (modality): 0 (optional)
- Direction 2 - Each order belongs to one and only one salesperson
 - maximum cardinality: 1
 - minimum cardinality (modality): 1 (required)

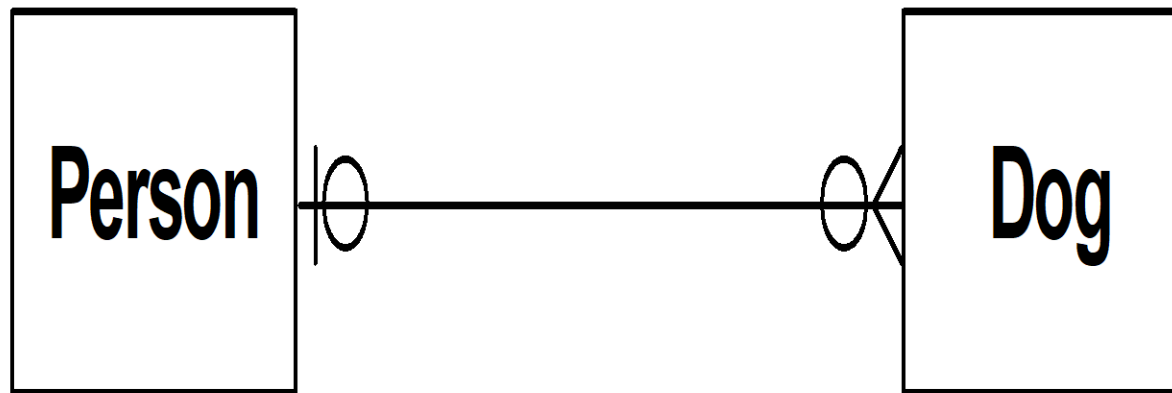


PERSON - DOG Relationship

- Direction 1 - Each person can own none or many dogs
 - maximum cardinality: N
 - minimum cardinality: 0 (optional)
- Direction 2 - Each dog is owned by none or one person
 - maximum cardinality: 1
 - minimum cardinality: 0 (optional)



Person – Dog ER Diagram

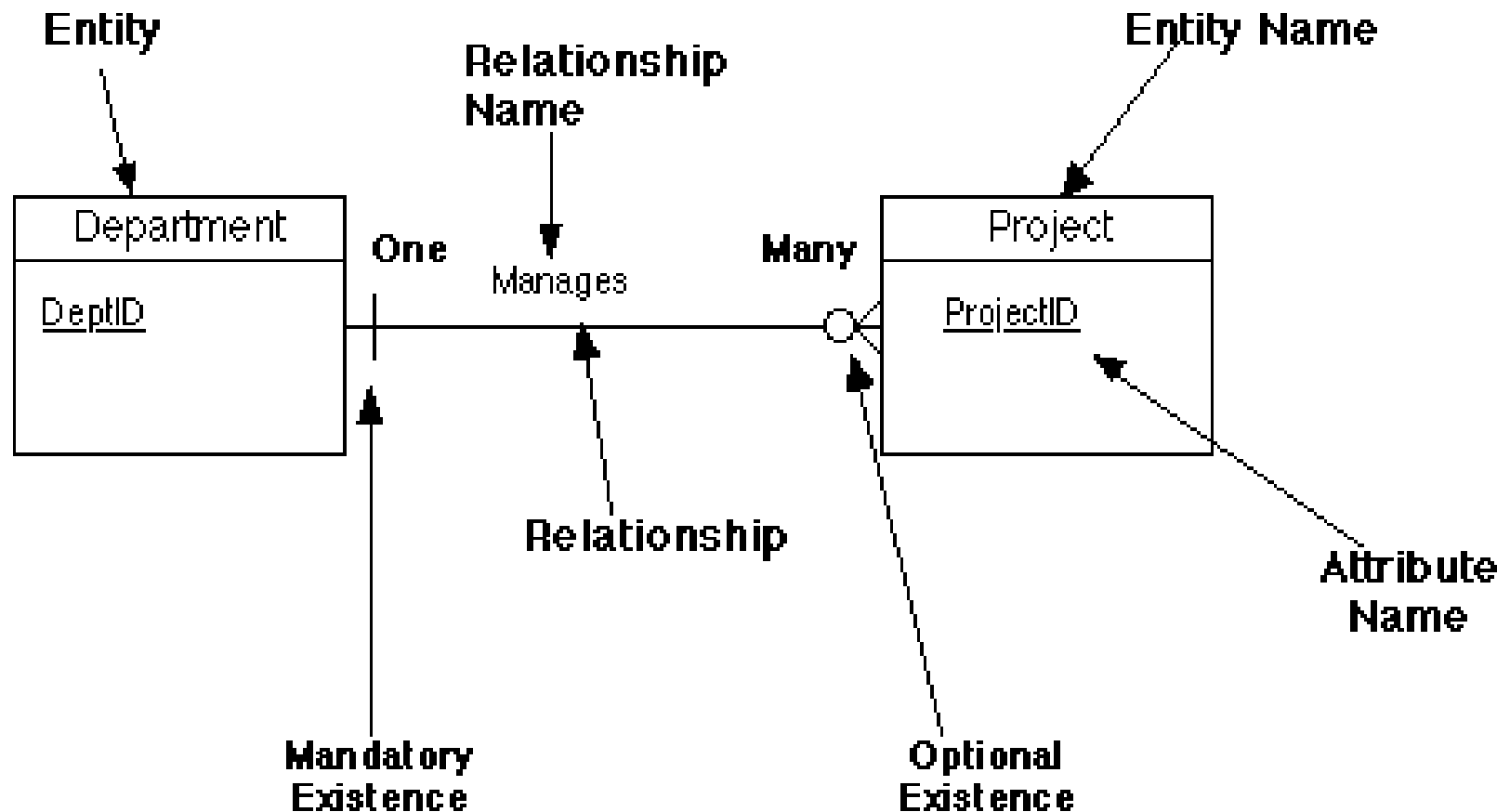


Each person can have zero or more dogs,
each dog is registered to zero or one person.

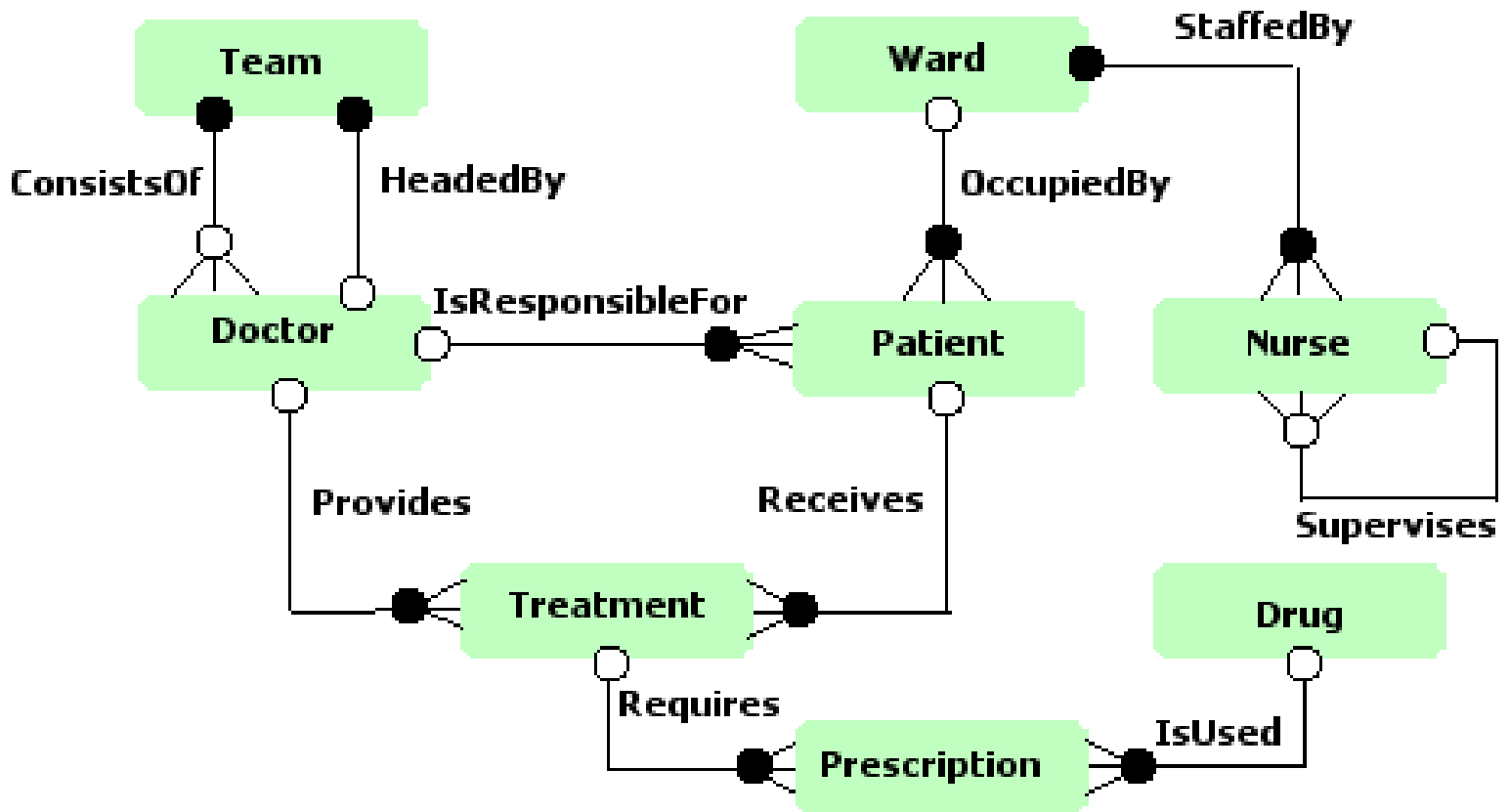
Types of Binary Relationships

- A binary relationship involves two entities – most common type of relationship – there are other types, but they are beyond the scope of this intro course
- Classified according to maximum cardinality
 - Often called “has a” relationships
 - One to One (PERSON to COMPUTER)
 - One to Many (SALESPERSON to ORDER)
 - Many to Many (ORDER to PRODUCT)

E-R Drawing Notation



E-R Diagram Example

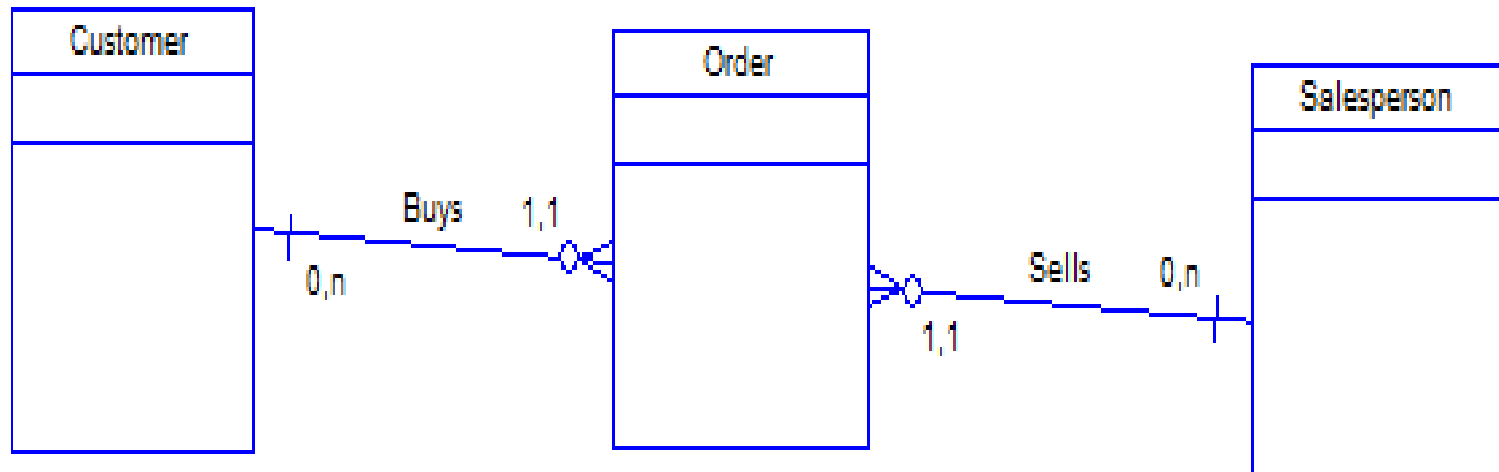


Database Management Systems



- **E-R diagrams are implemented in a database management system (DBMS)**
- **DBMS** is a set of programs that provide users with tools to add, delete, access and analyze stored data
- **There may be more tables in the database than entities in the E-R diagram**
- Popular examples of relational databases are *Microsoft Access, Oracle, SQLServer, DB2, and MySQL (open source)*

Customer-Order-Salesperson



S (Salesperson Table) – PK is Name

Name	Quota	Salary
Abel	63	120000
Baker	38	42000
Jones	26	36000
Kobad	27	34000
Murphy	42	50000
Zenith	59	118000

C (Customer Table) – PK is Name

Name	City	IndustryType
Abernathy Construction	Willow	B
Amalgamated Housing	Memphis	B
Manchester Lumber	Manchester	F
Tri-City Builders	Memphis	B

O (Order Table) – PK is Number (FK's are CustName & SalespersonName)

Number	CustName	SalespersonName	Amount
100	Abernathy Construction	Zenith	560
200	Abernathy Construction	Jones	1800
300	Manchester Lumber	Abel	480
400	Amalgamated Housing	Abel	2500
500	Abernathy Construction	Murphy	6000
600	Tri-City Builders	Abel	700
700	Manchester Lumber	Jones	150



Access Relationship Grid



Microsoft Access

File Edit View Relationships Tools Window Help

Type a question for help

chap9 : Database (Access 2000 file format)

Open Design New

Objects

- Tables
- Queries
- Forms
- Reports
- Pages
- Macros
- Modules

Groups

Create table in Design view

Create table by using wizard

Create table by entering data

C

O

S

Relationships

C

Name

City

IndustryType

1

∞

O

Number

CustName

SalespersonName

Amount

1

∞

S

Name

Quota

Salary

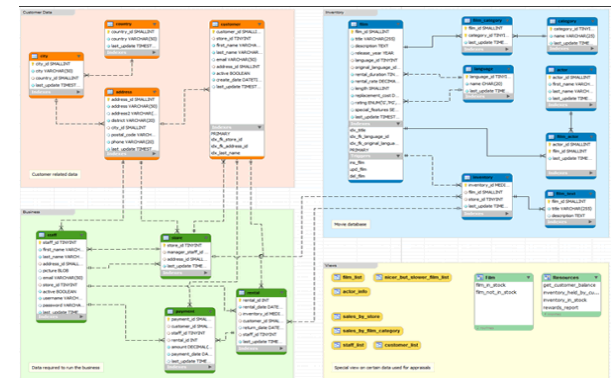
Ready

NUM

Other Types of Relationships

- Binary (degree 2)

- One to one
- One to many
- Many to many

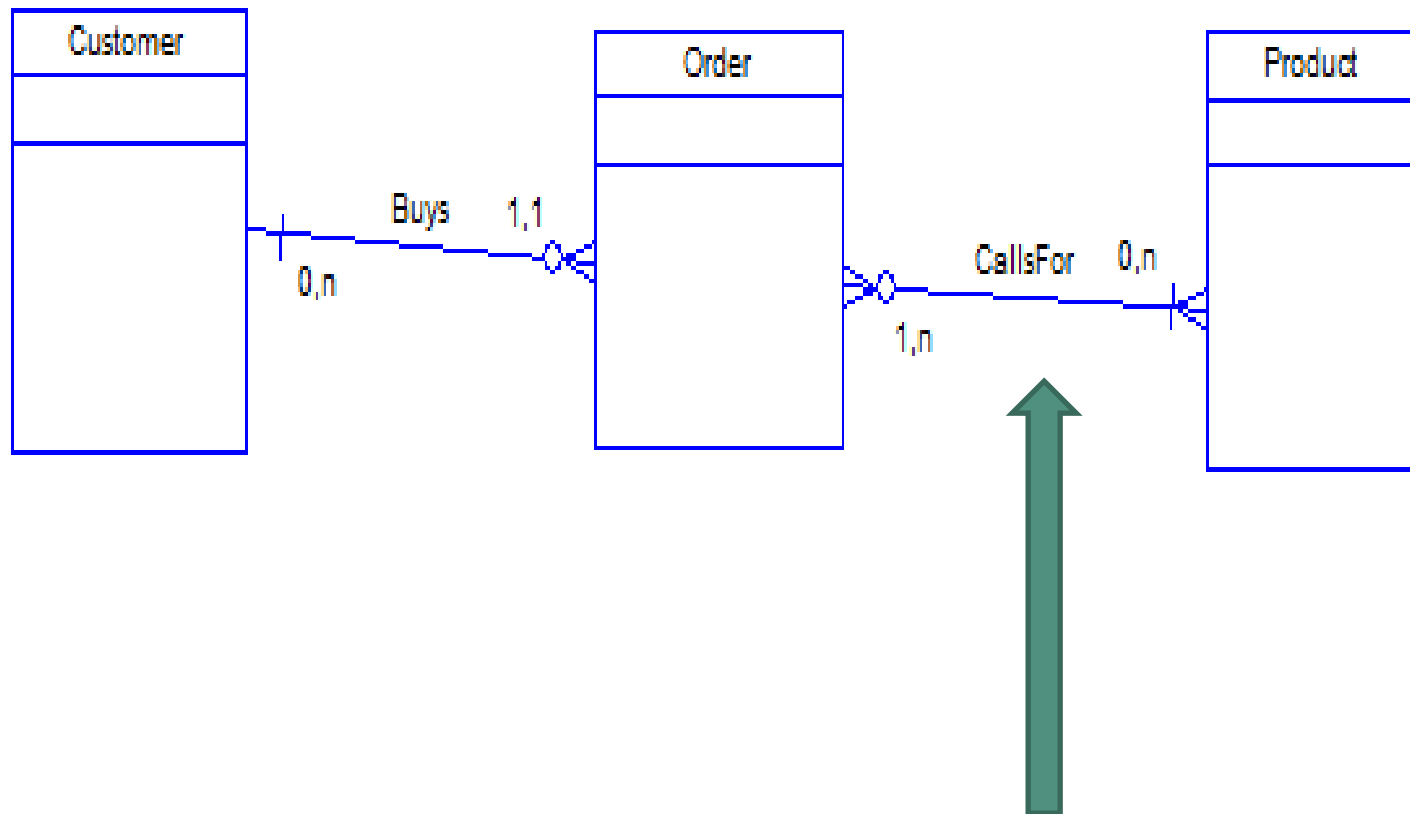


- Recursive (degree 1)

- High Order (degree > 2)

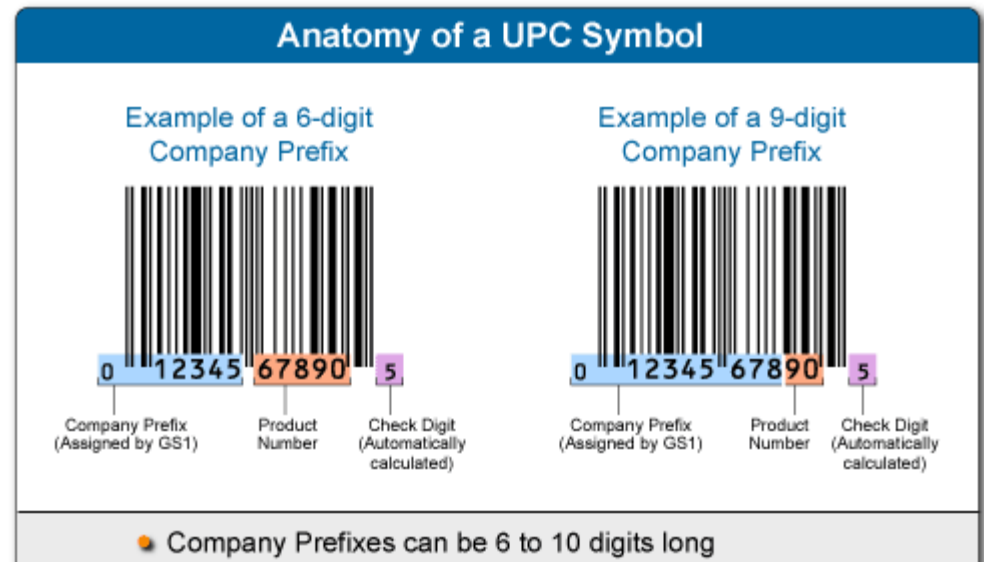
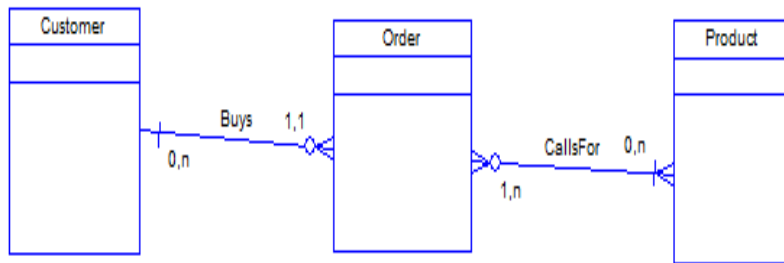
- Subtype (“is a” relationship)

There May Be More Tables In The Database Than Entities In The E-R Diagram

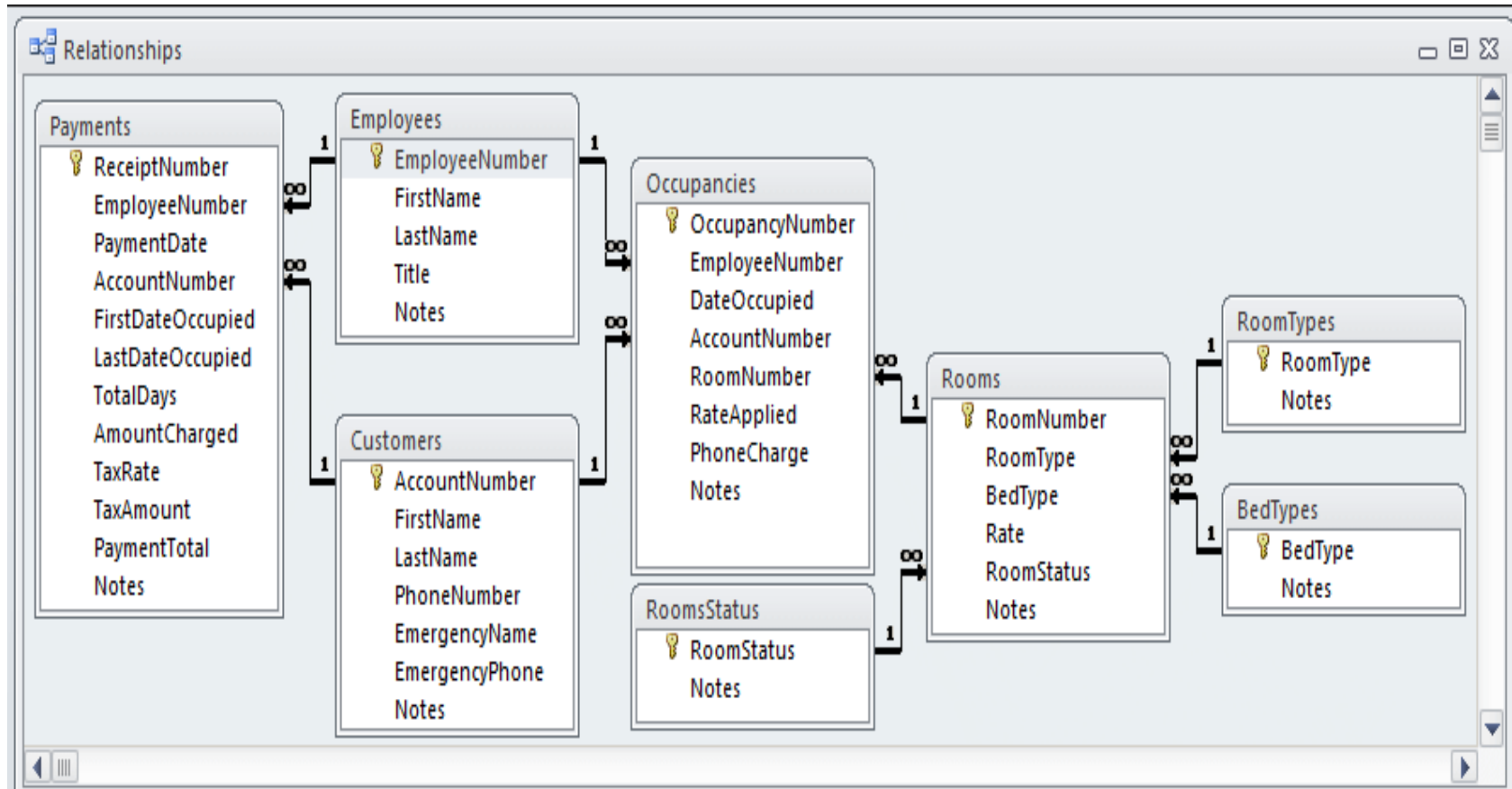


UPC Code

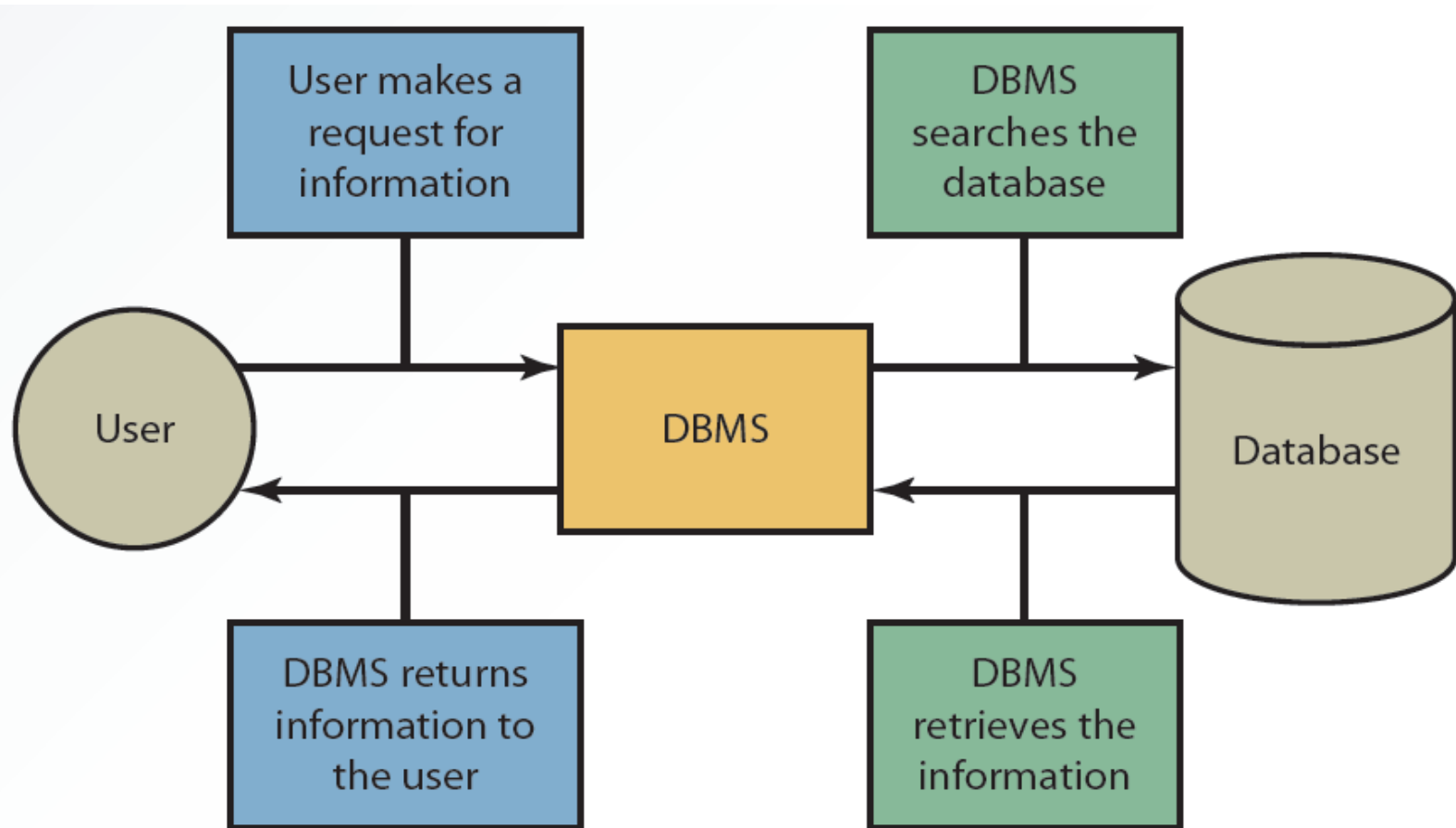
[product primary key]



Larger Access Model



Query – Request for Information

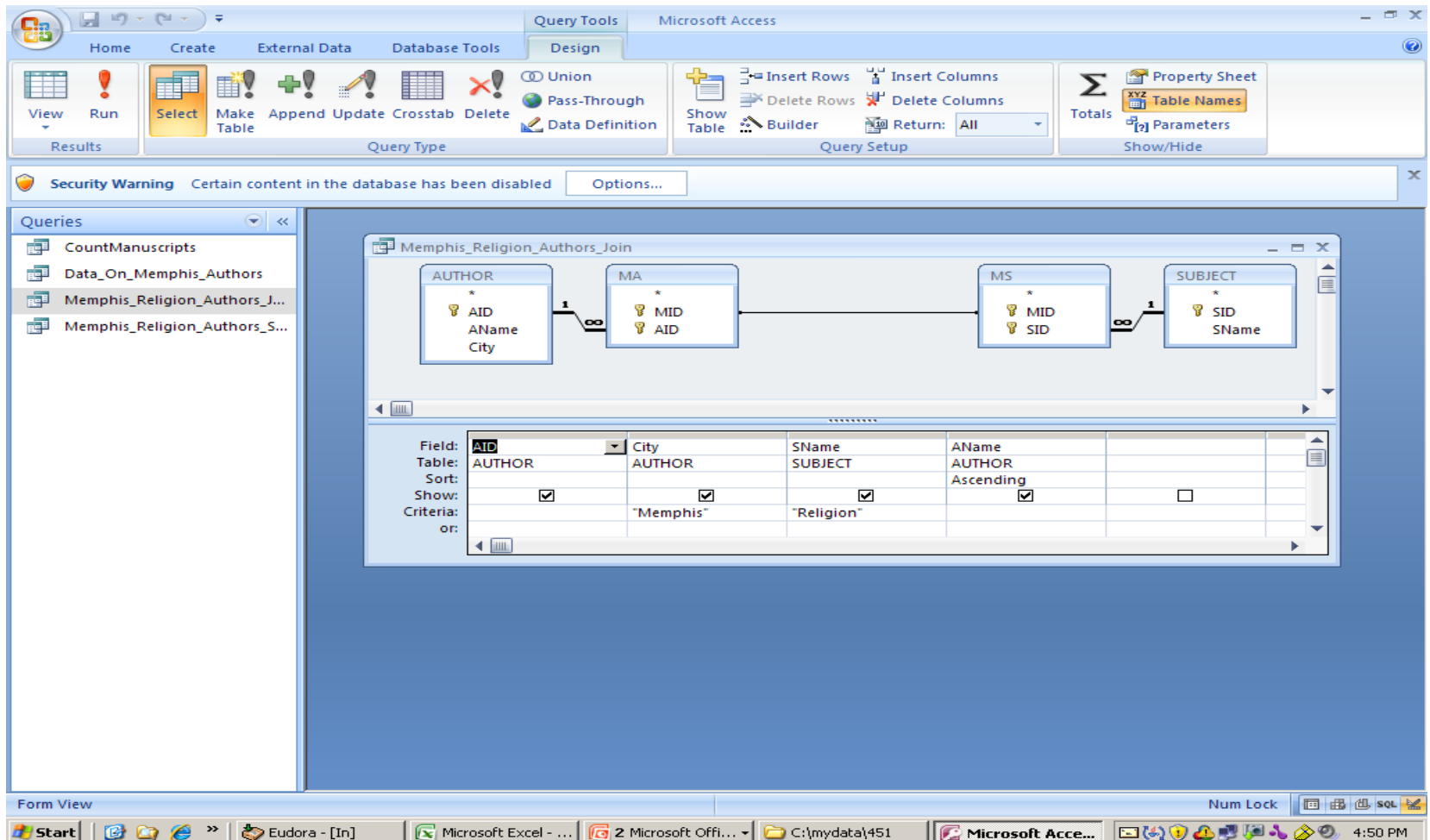


Query Languages

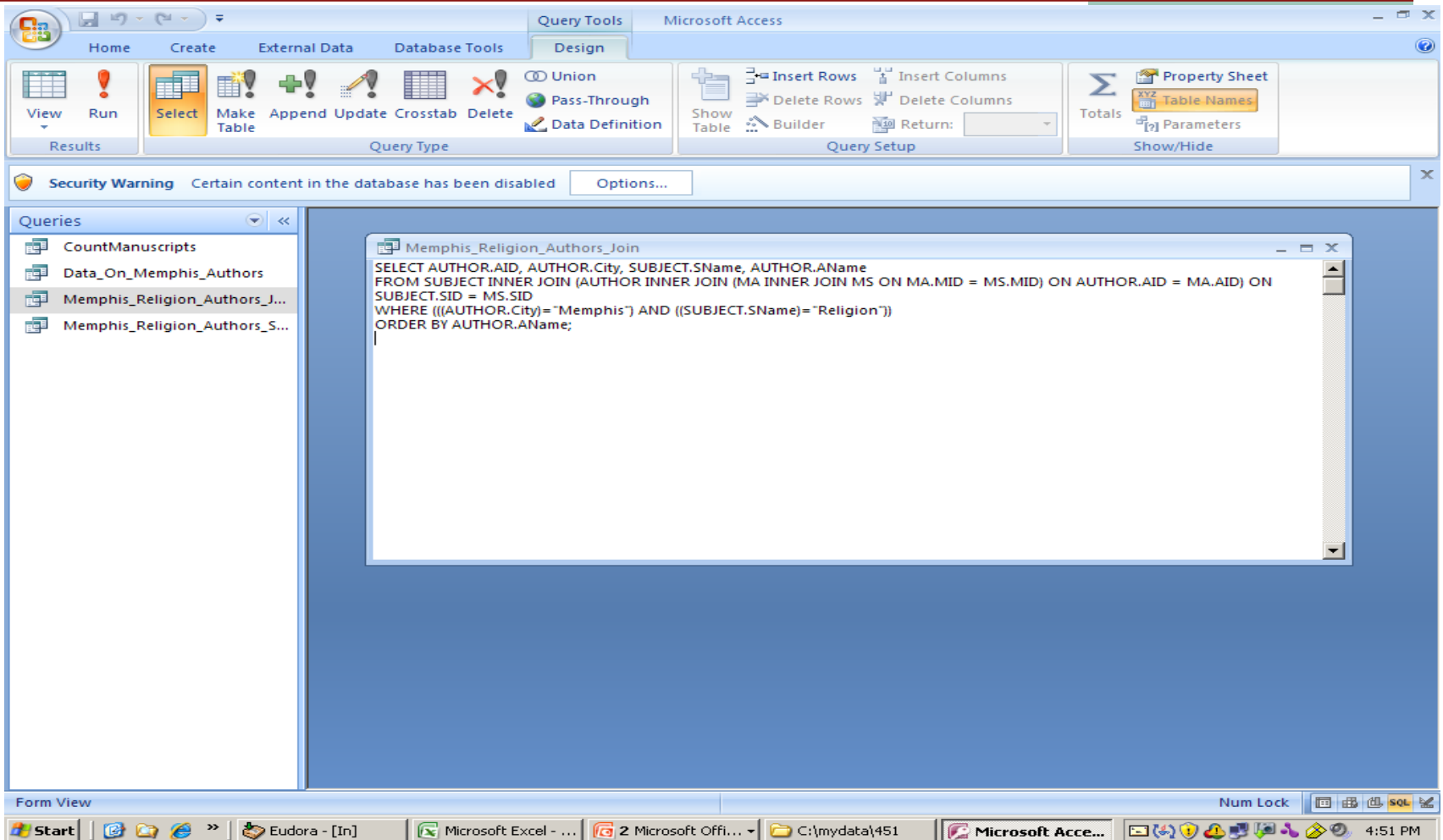


- **Query by example (QBE)** is a grid or template that a user fills out to construct a sample or description of the data wanted
- **Structured query language (SQL)** is the most popular query language used to request information
 - Covered in a database course
 - `SELECT * FROM S,O where S.Name = O.SalesPersonName Order by Amount`

Access Query by Example

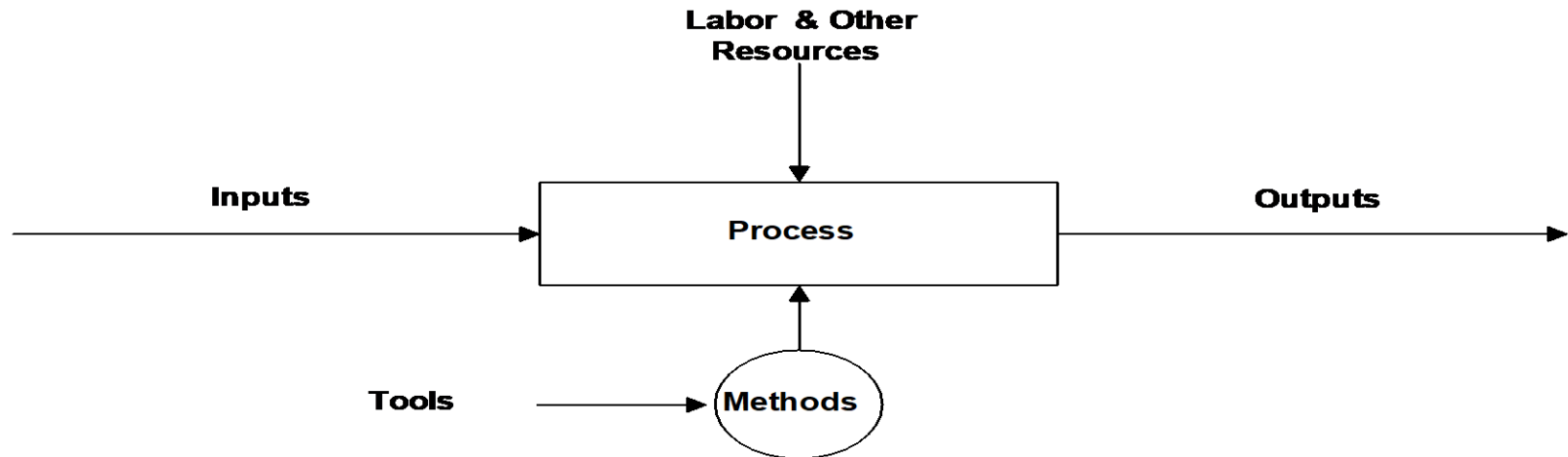


Access SQL View



Application Programs

- **Application program** is a computer program designed to support a specific task, a **business process**



The process is made up of ordered tasks !

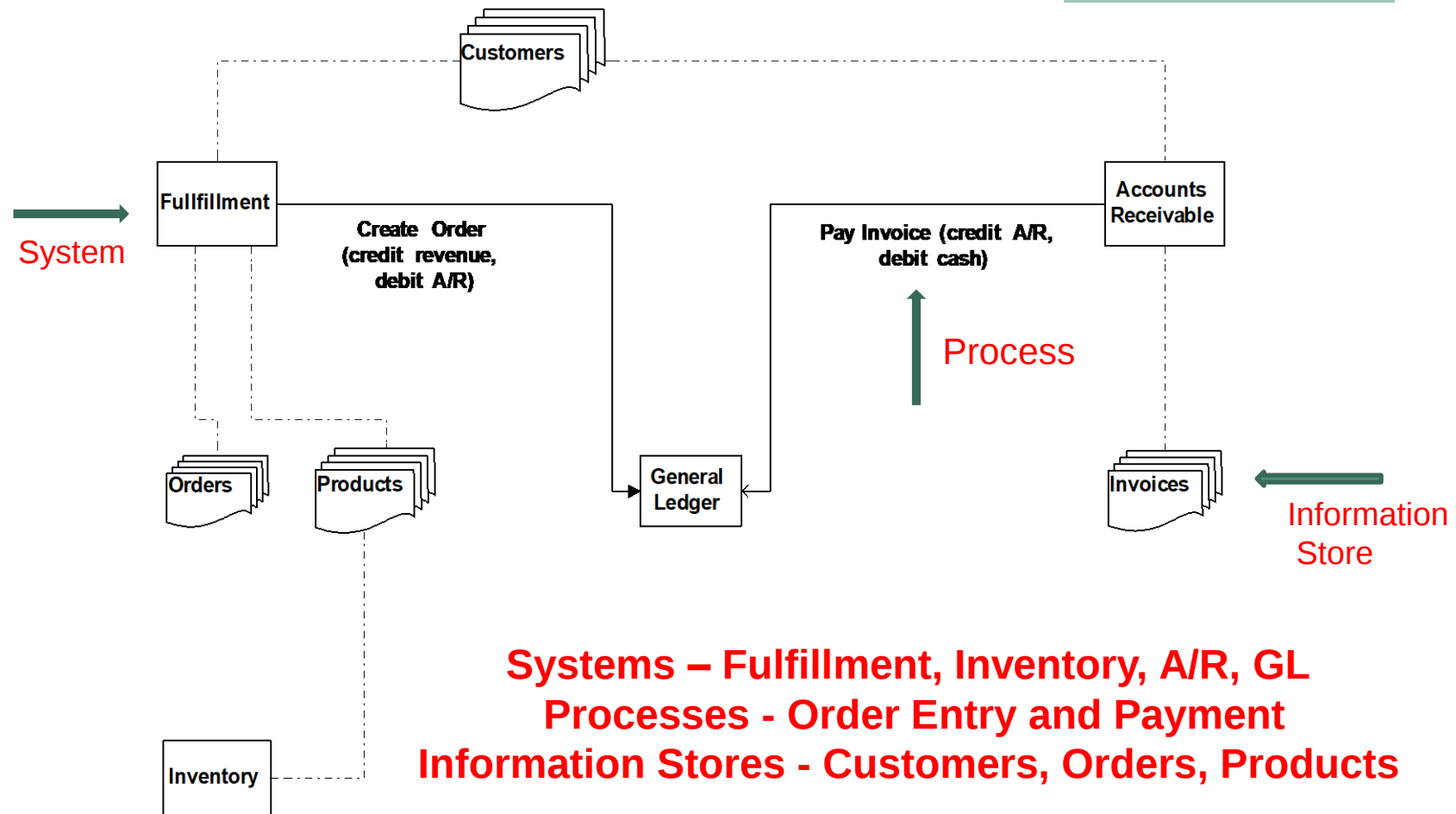
Business Processes



What is a “System”?

- It appears that often anything and everything is thought of as the “system”
- For IT, a system is:
 - a *set of interrelated IT components* (hardware, software, networks, databases, people, procedures, information), that must work together to achieve a common purpose

MIS Systems, Information, Processes



CRUD Process Analysis

- Consistency between the process model and the data model
- Indicates which IT process (the IT process is not necessarily a one to one correspondence with the business process) perform which operations on which database entities:
 - C – create (SQL “insert”)
 - R – read (SQL “select”)
 - U – update (SQL “update”)
 - D – delete (SQL (“delete”)

Database Tables & CRUD Matrix

Table detail not show
In CRUD matrix.

Database Tables

Customer
ID#
Name
Add
...

Order
#
Date
Cust ID#
Prod #
...

Product
ID #
Desc
Price
Qty on Hand
...



CRUD MATRIX

CUSTOMER

ORDER

PRODUCT

New Customer
Registration

C

-

-

Add New
Product

-

-

C

Accept New
Order

R

C

RU

CRUD Permission Model

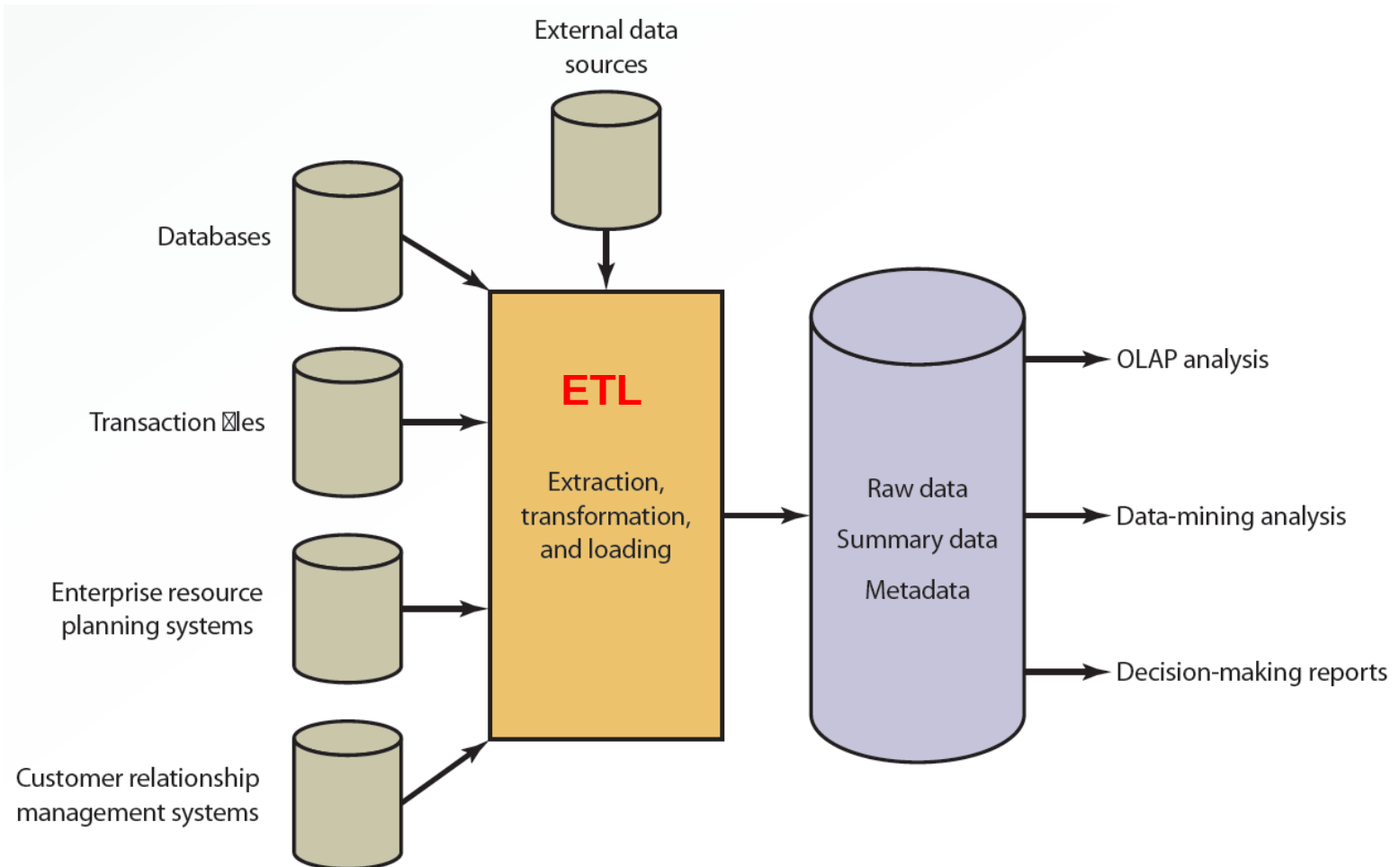
- The CRUD concept is **also used** in DBMS to **restrict usage** of database objects (queries/views, tables, fields, etc.) by database subjects (users, application programs, etc.)
 - **Which subjects have what kind of access to what objects**
- CRUD permissions are setup and maintained by the assigned Database Administrators (DBA's) for a database or group of databases

Data Warehousing



- **Data warehouse** is a repository of **historical data** organized by subject to support decision makers in the organization
- End users can access data quickly and easily via Web browsers because data is located in one place
- End users can conduct extensive analysis with data in ways not have been possible before
 - “slice and dice” data
- End users have a consolidated view of organizational data

Data Warehouse



Traditional Queries

Queries allow users to request information from the computer that is not available in periodic reports

Query systems are often based on menu/GUI based programs (which generate SQL) or via direct structured query language (SQL) or using a query-by-example (QBE) method such as the Access query grid

- User requests are stated in a query language and the results are subsets of the data in the relational tables:
 - Sales by department by customer type for specific period
 - Weather conditions for specific date
 - Sales by day of week
 - ...



OLAP



- On Line Analytical Processing (OLAP) is a new way of storing, viewing, and presenting information
- With it, data is viewed in **cubes**
- A two dimensional cube can be viewed as a table
- A three dimensional cube as a “cube”
- A multidimensional cube as a “hypercube”
- These cubes have axes, dimensions, measures, slices, and levels

OLAP (con't)

OLAP - An Example



Example: Relational Source Data (such as would appear in Access tables)

Category	Type	City	State	Date	Sales Price	Asking Price
New	Single Family	San Francisco	California	1/1/2000	679,000	685,000
Existing	Condo	Los Angeles	California	3/5/2001	327,989	350,000
Existing	Single Family	Elko	Nevada	7/17/2001	105,675	125,000
New	Condo	San Diego	California	12/22/2000	375,000	375,000
Existing	Single Family	Paradise	California	11/19/2001	425,000	449,000
Existing	Single Family	Las Vegas	Nevada	1/19/2001	317,000	325,000
New	Single Family	San Francisco	California	1/1/2000	679,000	685,000
Existing	Condo	Los Angeles	California	3/5/2001	327,989	350,000
Existing	Condo	Las Vegas	Nevada	6/19/2001	297,000	305,000
Existing	Single Family	Los Angeles	California	4/1/2000	579,000	625,000
New	Condo	Los Angeles	California	8/5/2001	321,000	320,000
Etc.						

Traditional query: What is the average sales price for new single family homes in LA in the 2QT of 2001 ?

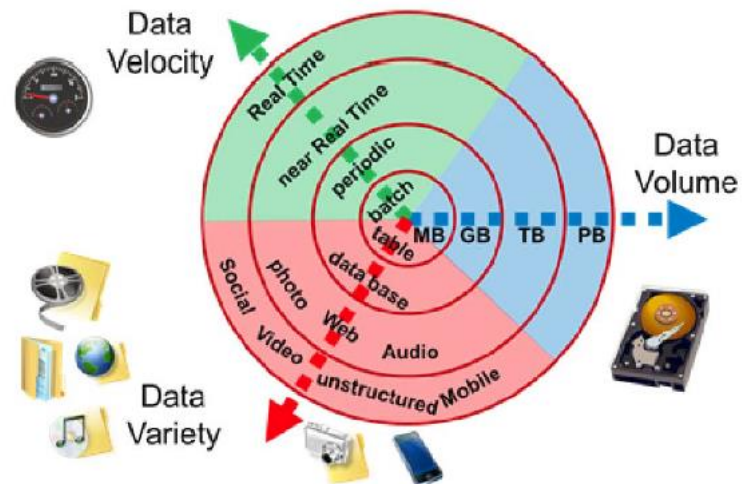
Example: OLAP Cube for Average Sales Price

[2 “axes” (rows and columns): date “dimensions” and type “dimensions”]

Average Sales Price of Single-Family Dwellings (\$thousands)										
			Existing Structures				New Construction			
			California			Nevada	California			Nevada
			San Francisco	Los Angeles	San Diego		San Francisco	Los Angeles	San Diego	
2000	Q1	Jan	408	465	375	179	418	468	371	190
		Feb	419	438	382	180	429	437	382	185
		Mar	427	477	380	195	426	471	387	198
	Q2		433	431	382	188	437	437	380	193
	Q3		437	437	380	190	438	439	382	190
	Q4		435	439	377	193	432	434	370	198
2001	Q1	Jan	452	454	368	198	450	457	367	197
		Feb	450	467	381	187	457	464	388	191
		Mar	432	444	373	188	436	446	371	201
	Q2		437	437	368	190	444	432	363	196
	Q3		436	452	388	196	447	455	385	199
	Q4		441	455	355	198	449	455	355	202

The “Big Data” Era

- Voluminous data
 - Not just internal data from transactions, but clickstream data, social media data, IoT data, etc.
 - Conventional computing methods maybe unable to efficiently process and manage it
- Involves five dimensions
 - Volume
 - Variety
 - Velocity
 - Veracity
 - Value



40 ZETTABYTES

(40 TRILLION GIGABYTES)
of data will be created by
2020, an increase of 300
times from 2005

6 BILLION PEOPLE
have cell phones

WORLD POPULATION: 7 BILLION

Volume SCALE OF DATA

It's estimated that
2.5 QUINTILLION BYTES
(2.5 TRILLION GIGABYTES)
of data are created each day



Most companies in the
U.S. have at least
100 TERABYTES
(100,000 GIGABYTES)
of data stored

The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**.

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise systems, sensors, and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

www.ibm.com/bizstat/bigdata

By 2015
4.4 MILLION IT JOBS
will be created globally to support big data
with 1.3 million in the United States



As of 2011, the global size of
data in healthcare was
estimated to be

150 EXABYTES
(150 TRILLION GIGABYTES)



**30 BILLION
PIECES OF CONTENT**
are shared on Facebook
every month



Variety DIFFERENT FORMS OF DATA

By 2014, it's anticipated
there will be

**420 MILLION
WEARABLE, WIRELESS
HEALTH MONITORS**

**4 BILLION+
HOURS OF VIDEO**
are watched on
YouTube each month



400 MILLION TWEETS
are sent per day by about 200
million monthly active users



The New York Stock Exchange
reports

**1 TB OF TRADE
INFORMATION**
during each trading session



Modern cars have close to
100 SENSORS
that monitor items such as
fuel level and tire pressure

Velocity ANALYSIS OF STREAMING DATA

By 2016, it is projected
there will be

**18.9 BILLION
NETWORK
CONNECTIONS**

(almost 2.6 connections
per person on earth)



**1 IN 3 BUSINESS
LEADERS**

don't trust the information
they use to make decisions



In one survey, were unsure or
how much of their data was
inaccurate

Veracity UNCERTAINTY OF DATA

Poor data quality costs the US
business around

\$3.1 TRILLION A YEAR



Other Types of Databases

- In addition to relational databases, there are other database structures that may be better suited for big data and other kinds of data:
 - Object oriented databases
 - Graph based databases
 - Distributed databases
 - NoSQL databases
 - Hadoop/MapReduce databases

Knowledge Discovery

Data warehousing also support the ability to “discover” new information that can be used for competitive advantage

The major objective of this **knowledge discovery in databases (KDD)** is to identify valid, novel, potentially useful, and understandable **patterns in data**

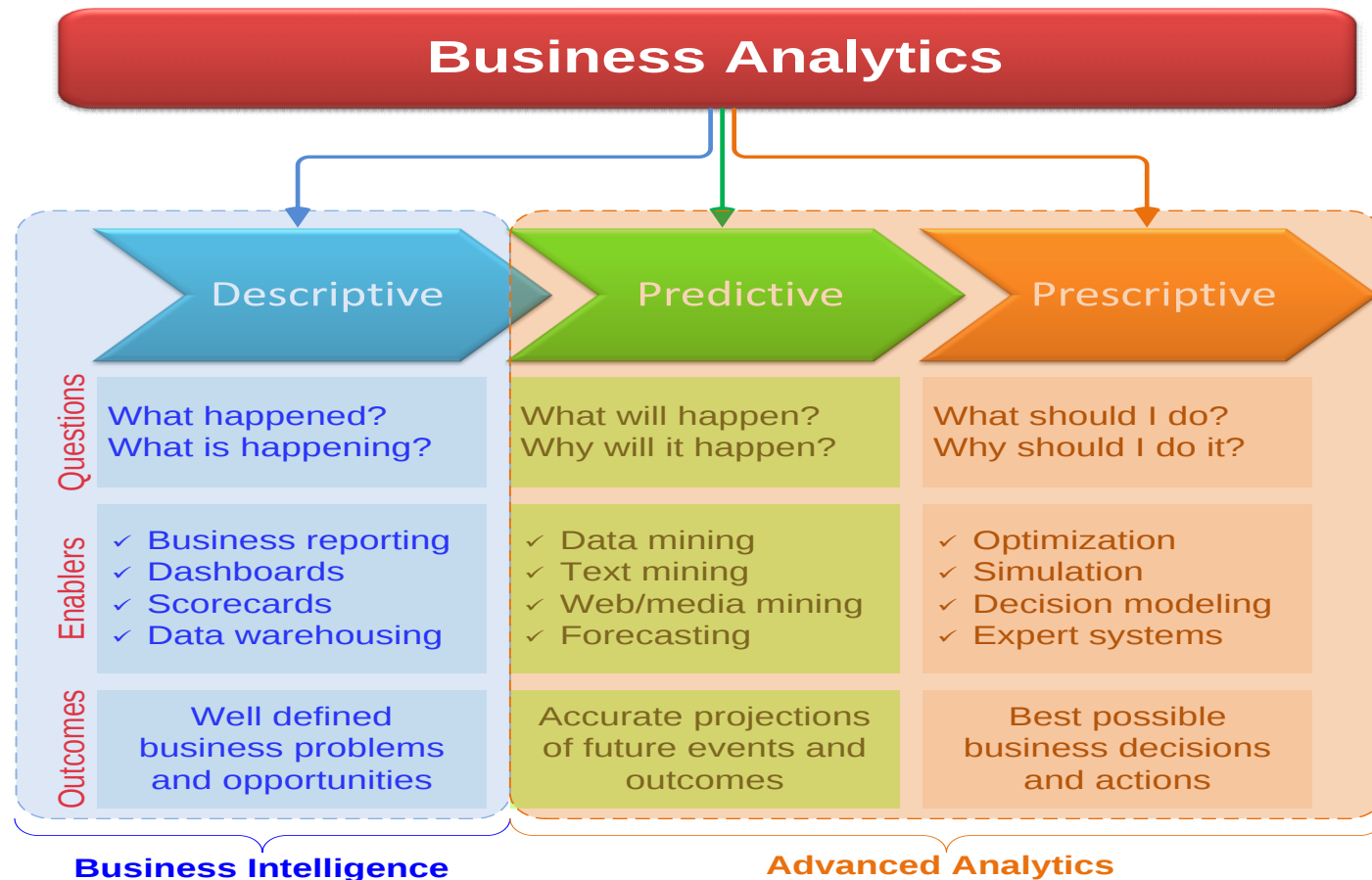
KDD (con't)

- KDD is supported by three technologies:
 - massive data collection (i.e. data warehouse)
 - powerful multiprocessor computers
 - **sophisticate algorithms** (“data analytics”)
- KDD primarily employs several tools for information discovery:
 - Traditional query languages (SQL, etc.)
 - **OLAP**
 - **Market basket analysis**
 - **Data mining**
 - **Data visualization**
 - **AI (artificial intelligence)**

Business Analytics

- Uses data, statistical methods, machine intelligence methods to:
 - Gain insight into the data
 - Provide decision makers with information to act on
- Methods
 - Descriptive
 - Reviews past events, analyzes the data, and provides a report indicating what happened in a given period of time
 - Predictive
 - Proactive strategy
 - Prepares decision makers for future events
 - Prescriptive
 - Recommends a course of action that decision makers should follow
 - Shows the likely outcome of each decision

Business Analytics (con't)



Data Analytic Jobs

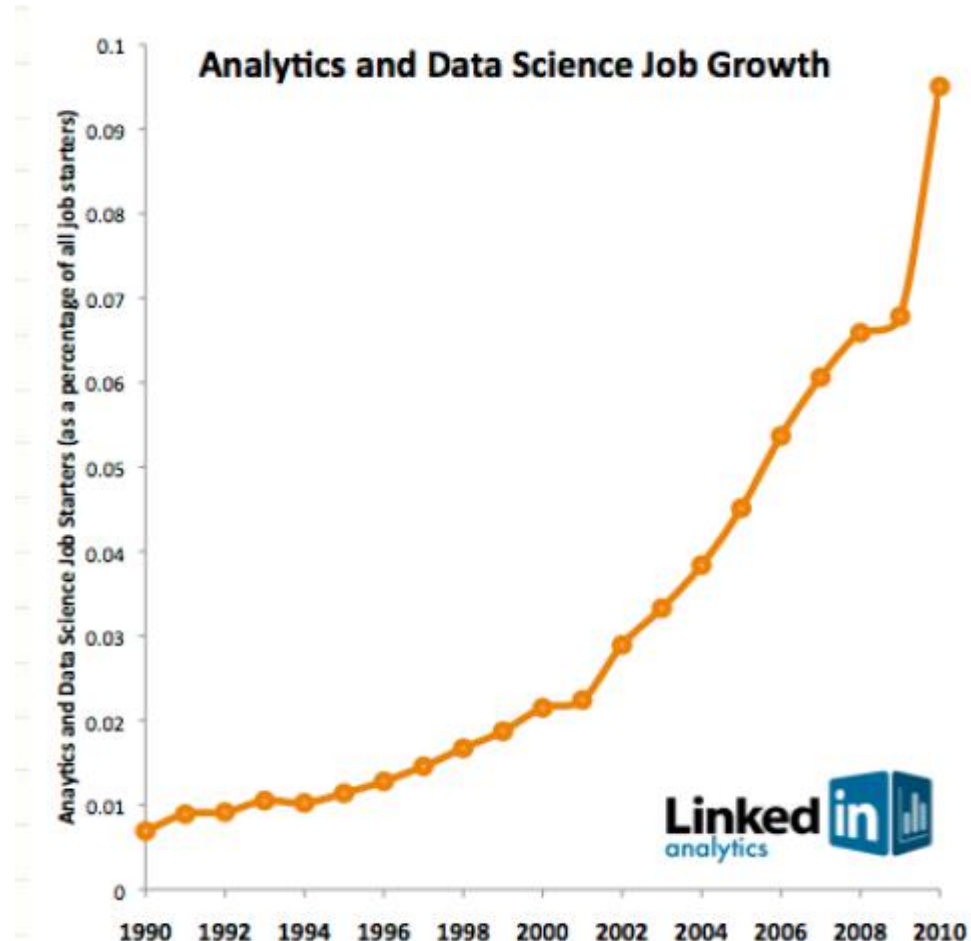
- ComputerWorld's Survey of its 100 IT leaders ranked their top five priorities:
 - **Business analytics**
 - Mobility (tablets, apps, etc)
 - Application development
 - Cloud computing
 - Security



Data Analytics Jobs

A report released recently by Glassdoor says that data scientists have the best jobs in the U.S., according to that company's analysis.

With a median base salary of \$116,840, more than 1,700 job openings on Glassdoor's site, and a user-provided career opportunities rating of 4.1, "data scientist" took the prize for most highly rated job title in America.



Access Lab

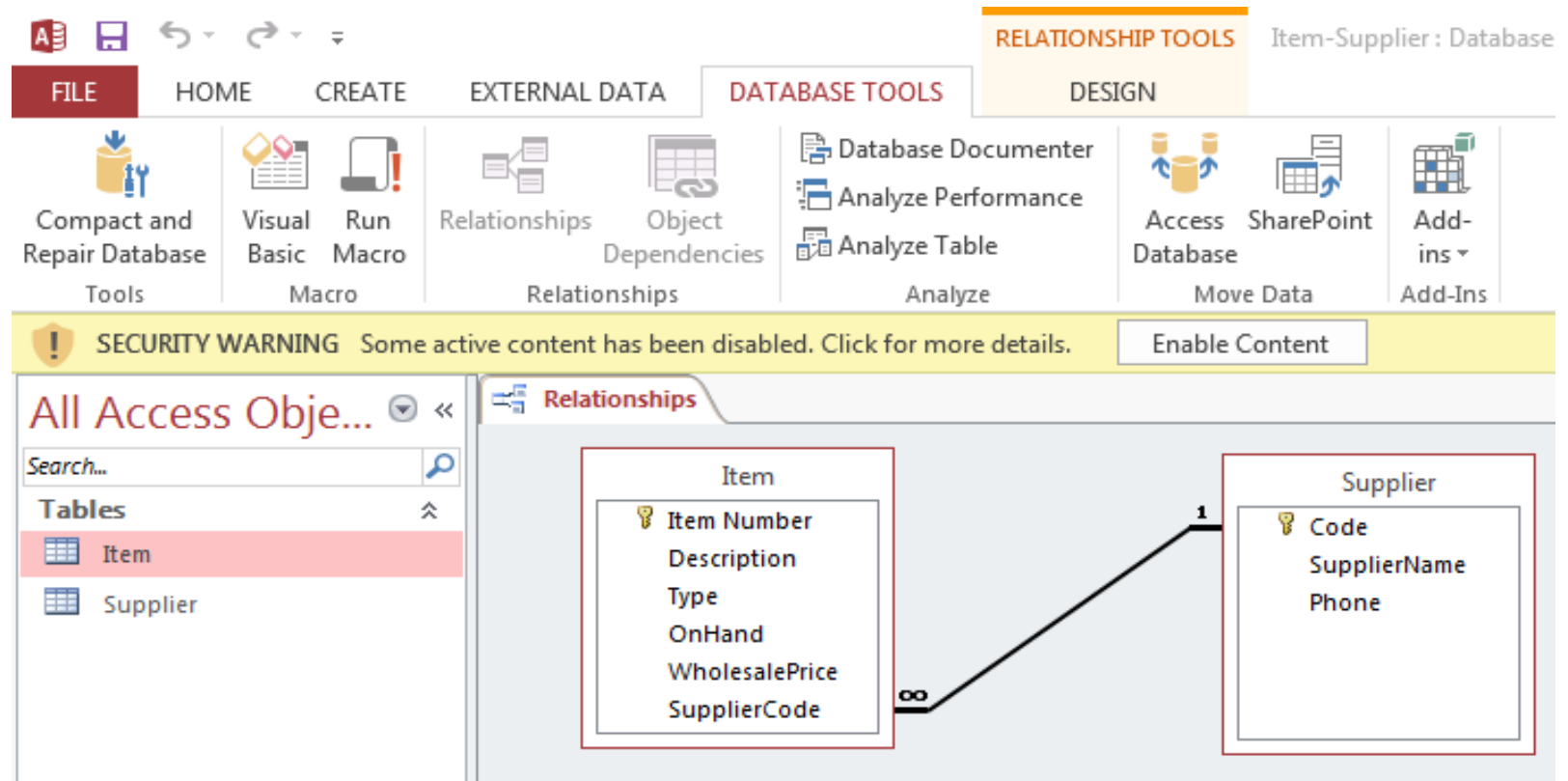
- Build a relational database using Access for the data shown below (in spreadsheet format)
- Set up primary and foreign keys (with referential integrity)
 - Design tables and relationships before entering data

Item Number ▾	Description ▾	Item Type ▾	On Hand ▾	Wholesale ▾	Supplier Code ▾	Supplier Name ▾	Phone ▾
8673	Cotton Visor	Cap	145	\$4.59	LM	Last Merchants	803-555-7641
6234	Foam Visor	Cap	225	\$0.79	LM	Last Merchants	803-555-7641
7363	Baseball Cap	Cap	105	\$4.87	LM	Last Merchants	803-555-7641
8344	V-Neck Pullover	Clothing	76	\$13.60	LM	Last Merchants	803-555-7641
8590	V-Neck Vest	Clothing	65	\$20.85	LM	Last Merchants	803-555-7641
4543	Crew Sweatshirt	Clothing	90	\$7.29	PC	PJPratt Clothing	517-555-3853
6185	Fleece Vest	Clothing	45	\$28.80	PC	PJPratt Clothing	517-555-3853
6345	Golf Shirt	Clothing	125	\$10.06	PC	PJPratt Clothing	517-555-3853
8206	Turtleneck	Clothing	55	\$11.29	PC	PJPratt Clothing	517-555-3853
9458	Windbreaker	Clothing	54	\$15.17	PC	PJPratt Clothing	517-555-3853
9583	Crew T-Shirt	Clothing	125	\$2.81	PC	PJPratt Clothing	517-555-3853
5923	Drink Holder	Novelty	80	\$0.82	SD	Scrypt Distributors	610-555-8741
6523	Mouse Pad	Novelty	150	\$1.29	SD	Scrypt Distributors	610-555-8741
6974	Pen	Novelty	225	\$0.49	SD	Scrypt Distributors	610-555-8741
7123	Sports Bottle	Novelty	150	\$1.04	SD	Scrypt Distributors	610-555-8741
7934	Tote Bag	Novelty	225	\$1.26	SD	Scrypt Distributors	610-555-8741
8136	Travel Mug	Novelty	80	\$2.47	SD	Scrypt Distributors	610-555-8741



Don't look ahead !

Item – Supplier Database



Foreign key is the SupplierCode in the Item table.

Apple/Mac Computers

- CBU students have a free license to Microsoft Office 365 for the Windows apps
- Not all Office 365 apps will run directly on a Mac such as Access
- One can install Parallels on a Mac to provide for running Access and such apps
 - https://www.parallels.com/products/desktop/?gclid=EAlaIQobChMILjtseqP7wIVDotaBR0Vcw6nEAA YASADEglfhfD_BwE

Apple/Mac Computers (con't)

- Parallels currently only works on Macs that still have Intel processors in them
- In 2021 Apple started transitioning their machines to their own in-house processors, and several models have already been released (MacBook Air, MacBook Pro 13", and Mac Mini.); these have an Apple-made ARM processor called the M1 - On these machines, it is currently impossible to virtualize or native boot Windows

 [Products](#) [Support](#) [Partners](#) [My Account](#) [US / English](#) [Search...](#)

[Parallels Desktop 16 for Mac](#) [Overview](#) [What's New v16](#) [Resources](#) [Support](#) [TRY NOW](#)



NEW!

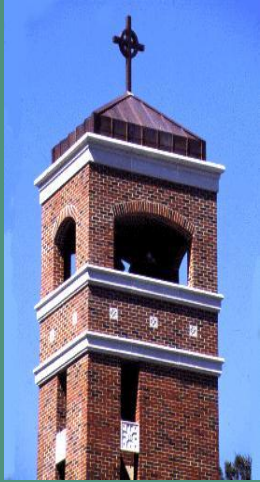
Parallels Desktop 16 for Mac

Run Windows on Mac

- Develop & test across multiple OSes in a virtual machine for Mac
- Access Microsoft Office for Windows and Internet Explorer
- Fast—run Windows apps without slowing down your Mac
- Quickly move files, apps and more from a PC to a Mac

[BUY NOW](#) [DOWNLOAD FREE TRIAL](#)

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Introduction to MIS

Competitive Advantage

Competitive Advantage and Strategic Information Systems

- **Competitive Advantage:** An advantage over competitors in some measure such as cost, quality, or speed -> better, cheaper, faster
 - leads to control of a market and to larger than average profits
- **Strategic Information Systems (SIS)** provide a competitive advantage by helping an organization to implement its strategic goals and to increase its performance and productivity

Porter's Competitive Forces Model

- The best-known framework for analyzing **competitiveness** is Michael Porter's **competitive forces model** (Porter, 1985)
- The model is used to develop strategies to increase one's competitive edge
- Also used today to demonstrate how IT can make a company more competitive



Porter's Competitive Forces Model

WHAT IS THE FIVE FORCES MODEL OF PORTER? DESCRIPTION

The Five Forces model of Porter is an Outside-in business unit strategy tool that is used to make an analysis of the attractiveness (value) of an industry structure. The Competitive Forces analysis is made by the identification of 5 fundamental competitive forces:

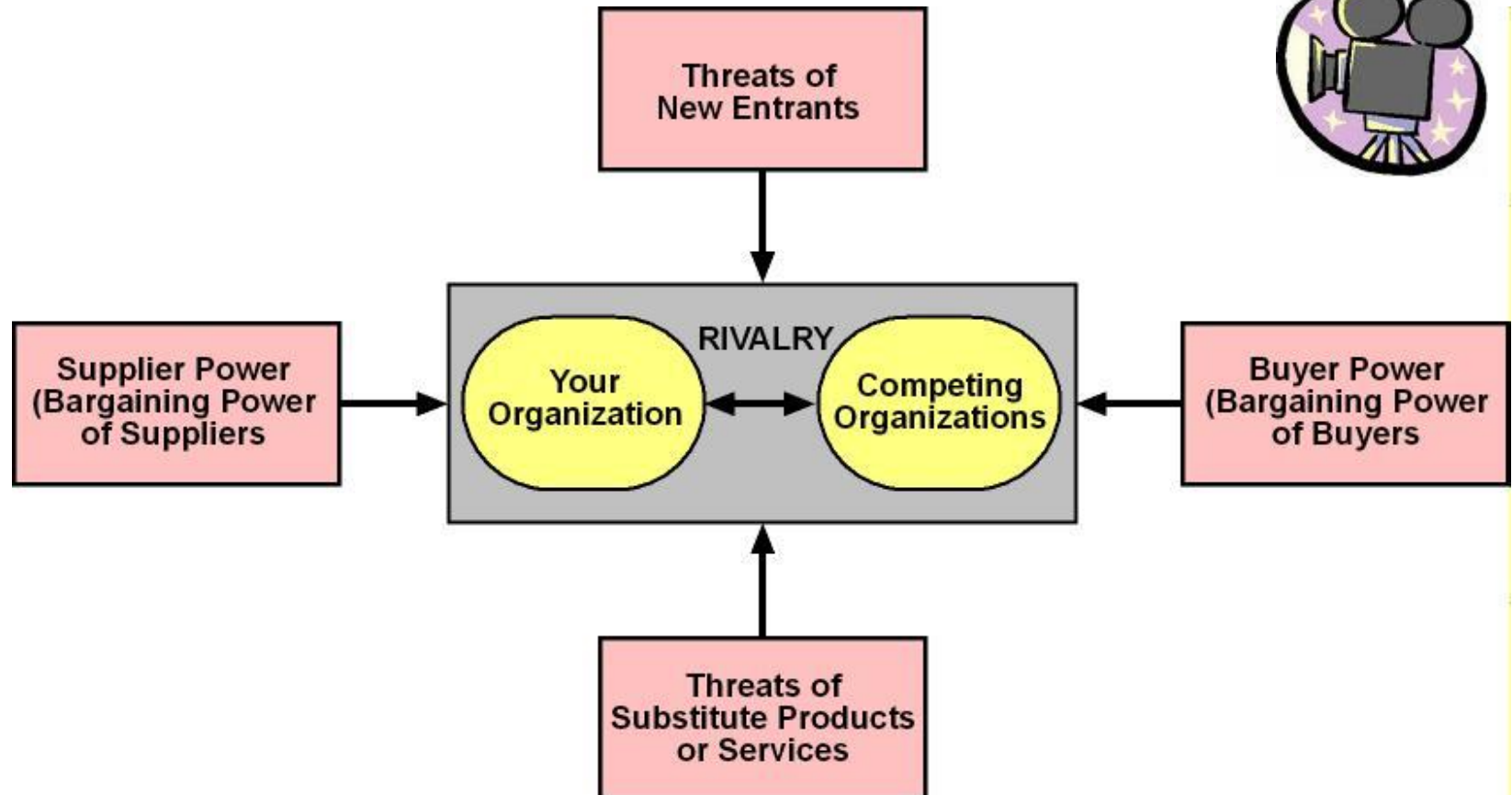
1. **Entry of competitors.** How easy or difficult is it for new entrants to start competing, which barriers do exist.
2. **Threat of substitutes.** How easy can a product or service be substituted, especially made cheaper.
3. **Bargaining power of buyers.** How strong is the position of buyers. Can they work together in ordering large volumes.
4. **Bargaining power of suppliers.** How strong is the position of sellers. Do many potential suppliers exist or only few potential suppliers, monopoly?
5. **Rivalry among the existing players.** Does a strong competition between the existing players exist? Is one player very dominant or are all equal in strength and size.



Sometimes a sixth competitive force is added:

6. **Government.**

Porter's Competitive Forces Model

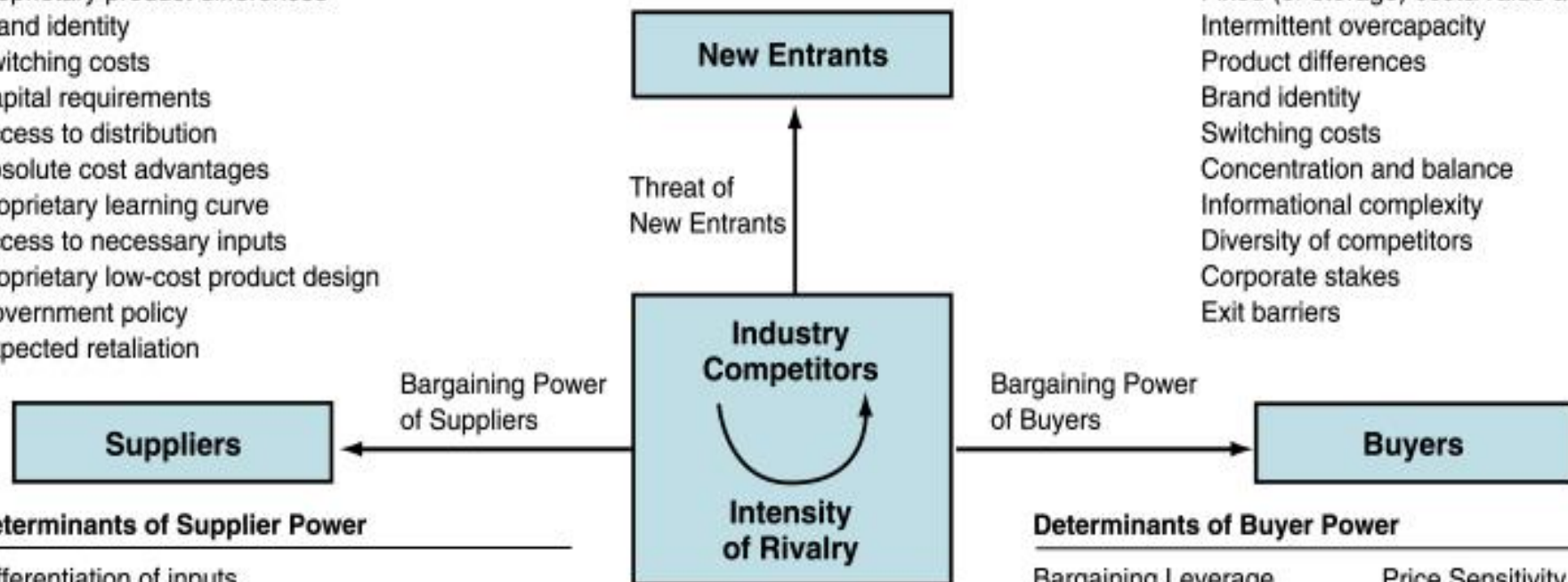


Entry Barriers

Economies of scale
Proprietary product differences
Brand identity
Switching costs
Capital requirements
Access to distribution
Absolute cost advantages
Proprietary learning curve
Access to necessary inputs
Proprietary low-cost product design
Government policy
Expected retaliation

Determinants of Rivalry

Industry growth
Fixed (or storage) costs/value added
Intermittent overcapacity
Product differences
Brand identity
Switching costs
Concentration and balance
Informational complexity
Diversity of competitors
Corporate stakes
Exit barriers



Determinants of Supplier Power

Differentiation of inputs
Switching costs of suppliers and firms in the industry
Presence of substitute inputs
Supplier concentration
Importance of volume to supplier
Cost relative to total purchases in the industry
Impact of inputs on cost or differentiation
Threat of forward integration relative to threat of backward integration by firms in the industry

Determinants of Buyer Power

Bargaining Leverage	Price Sensitivity
Buyer concentration versus firm concentration	Price total purchases
Buyer volume	Product differences
Buyer switching costs relative to firm switching costs	Brand identity
Buyer information	Impact on quality/performance
Ability to backward integrate	Buyer profits
Substitute products	Decision makers' incentives
Pull-through	

Determinants of Substitution Threat

Relative price/performance of substitutes
Switching costs
Buyer propensity to substitute

Common Strategies for Competitive Advantage

- **Cost Leadership.** Produce products and/or services at the lowest cost in the industry
 - Typically only one low cost leader within an industry area
 - What happens when there is more than one ?
- **Differentiation.** Offer different products, services, or product features than competitors
- **Innovation.** Introduce new products and services, add new features to existing products and services, or develop new ways to produce them or support them →

Strategies for Competitive Advantage (con't)

- **Niche strategy** – select a narrow-scope segment and be the best in quality, speed, or cost in that market
 - Geographic, demographic, etc.
- **Growth strategy** – increase market share, acquire more customers, or sell more products
- **Alliance strategy** – work with business partners in partnerships, alliance, joint ventures or virtual companies →

Strategies for Competitive Advantage (con't)

- **Time strategy** – treat time as a resource, then manage it and use it to the firm's advantage
- **Entry-barriers strategy** – create barriers to entry for new competitors
- **Lock in customers or suppliers strategy** – encourage customers or suppliers to stay with you rather than going to competitors
- **Increase switching costs strategy** – discourage customers or suppliers from going to competitors for economic reasons →

Strategies for Competitive Advantage (Continued)

- **Operational Effectiveness.** Improve the manner in which internal business processes are executed so that a firm performs similar activities better than its rivals
- **Customer-orientation.** Concentrate on making customers happy
- How can IT empower these strategies ?

Strategies for Competitive Advantage

- Cost Leadership



- Differentiation



- Innovation



- Operational Effectiveness

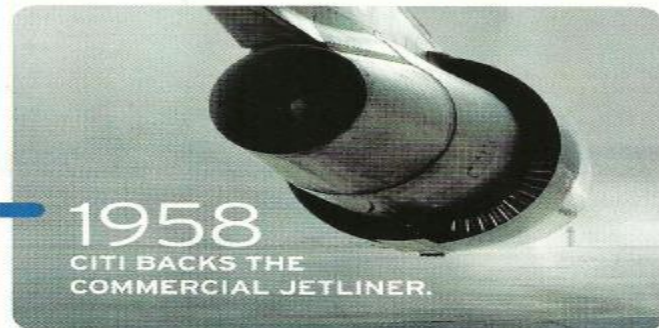


- Customer-orientation



CitiBank

**FOR TWO
CENTURIES,
WE'VE MEASURED
SUCCESS NOT
JUST IN DOLLARS,
BUT IN CHANGE.**



Necessity is the Mother of Innovation



To lure hungry patrons who are wary of indoor dining in the age of the coronavirus, restaurants are launching a feast of new projects to deliver better drive-thru service.

Shake Shack unveiled plans for its first-ever drive-thru—with in-person ordering and dedicated mobile lanes—set to open next year, though the global eatery has been mum about the project location so far. Chipotle, which had only 10 drive-thru “Chipotlanes” in February 2019, has since launched more than 100 of them at existing locations and has more than 80 additional planned for new restaurants over the next year.

Even drive-thru-tested restaurants are looking to improve the experience. In August, Taco Bell unveiled a new design for a dual-lane drive-thru with dedicated curbside delivery and mobile pickup shelves, along with heavily tech-integrated kitchens that inform workers the fastest way to make the order and communicate to the customer the easiest way to pick up the food. The first locations featuring the new designs are expected to open in early 2021.

“Projects we anticipated would take five to 10 years are being prioritized and integrated into [the drive-thru] experience as we go forward,” Mike Grams, president and global COO of Taco Bell, told



Fast Company. “COVID has [proven] customers want easy, convenient access to the things they love.”

Starbucks, which saw its mobile and drive-thru orders jump from roughly 60 percent of sales volume before the pandemic to 90 percent in the third quarter, plans to introduce handheld point-of-sale tablets that allow employees to take orders on foot in the drive-thru line. And when that line gets too long? Starbucks is also developing a system that would allow customers to park after ordering and pick up inside.

The Edge written by:
Ambreen Ali, Steve
Hendershot, Amanda
Hermans, Jen Thomas
and Amy Wilkinson

Restaurant Innovations



1.
Delivery
1922

New Los Angeles Chinese restaurant Kin-Chu Cafe promises delivery until 1 a.m., one of the first instances of telephone-based food ordering.

The impact: Delivery is a \$43 billion business annually in the United States, and apps such as GrubHub and Postmates offer delivery from just about any restaurant.

2.
Drive-through
1948

The first In-N-Out Burger allows drivers to order through an intercom and pick up from a window—without stepping out of the car.

The impact: With up to 70% of fast-food sales coming via the drive-through lane, even higher-end chains such as Starbucks and Chipotle have been forced to embrace the system.

3.
Credit card
1950

Diners Club becomes the first multipurpose charge card, eliminating the need for cash or a house account at upscale restaurants.

The impact: Bill-paying tech continues to evolve, with restaurateurs embracing startups that offer prepaid ticketing (Tock) or eliminate the check drop and replace it with pay-by-phone (Resy).

4.
The McDonald's system
1955

After Ray Kroc opens the first McDonald's franchise in Des Plaines, Illinois, he institutes consistent prep methods and sets up a supply chain to ensure uniform quality while expanding rapidly.

The impact: Almost every chain since has tried to emulate its prowess; Just Salad, for one, touts its employees' ability to toss 60 salads an hour.

5.
Electronic cash register
1973

IBM rolls out the 3650 Retail Store System, a client-server mainframe for tracking orders and inventory.

The impact: Since McDonald's adopted computerized order entry in 1974, systems have become increasingly sophisticated; Square delivers even more power—in a tablet computer.

6.
Molecular gastronomy
1987

A microbiologist experiments with making ice cream using liquid nitrogen (rather than churning), inadvertently inventing Dippin' Dots.

The impact: Molecular gastronomy is now mainstream; Smitten is a popular liquid-nitrogen ice cream chain; Panera and others use cooking techniques such as sous vide.

7.
Internet ordering
1994

The promise of ordering a pizza via the internet becomes a reality when Pizza Hut takes the first digital order—large pepperoni with mushrooms and extra cheese.

The impact: About half of all U.S. pizza orders are now digital, and Domino's has usurped Pizza Hut with its pizza tracker and emoji ordering.

8.
Data-driven restaurant management
1999

Owners ran restaurants by feel until the startup Avero created software to analyze sales and inventory to reveal insights such as which servers are best at wooing customers to order dessert.

The impact: Data now rules the guest experience as well, via services such as Yelp, which has tools to manage reservations, wait times, and rewards.

9.
Instagram
2010

Instagram cofounder Kevin Systrom's first photos on the app are from San Francisco's Tacos Chila-kos stand, establishing the relationship between food and photo sharing.

The impact: Taco Bell creates products like the Quesalupa for its Instagrammable cheese pull; avocado toast sales boom because it's pretty.

10.
Robots!
2017

Domino's Pizza announces a test to deliver via self-driving cars. Customers grab their order from the back, no human interaction necessary.

The impact: Robots are also being deployed to make food—Chowbotics is a salad maker and Cafe X a barista—and chains such as McDonald's and Wendy's are rolling out self-serve order kiosks.

Student Project Competitive Analysis Example

	Your Company				
PricingPurpose					
Price					
Subscription Features					
App & Web Accessible					
Available Internationally?					
International content uniform?					

Student Team Comparative Analysis

TRYP

Technological innovative:

- 5 different transportation departments. (Car, Bus, Train, Aero, Marine)
- Autonomous vehicles.
- Increased user-friendly database systems.
- Environmentally friendly
- Commercial Usage

Technological Innovative:

- Single Use (Cars)
- Vary by driver
- Personal vehicles, placing liability

Uber/Lyft

Student Team Competitive Analysis

CBSN	ESPN	NCAA WEBSITE	COLLEGE WEBSITES
CBSN provides sports streaming and sports analytics for all CBU sports teams	ESPN is one of the biggest sports broadcasts in the world. It shows a lot of different sports and colleges sports included.	NCAA website covers a lot of different sports from different schools. It shows different games and gives news about teams.	Basically all colleges have one type of stream to show the games from the different teams.
College Sports for CBU	All Sports Fans	College Sports Fans	College Sports Fans

Continued →

	CBSN	ESPN	NCAA WEBSITES	COLLEGE WEBSITES
	Subscription/ Local Advertisements	\$25-\$40 monthly	Free	Free but sometime requires an access code.
	Online Focus to college students who are very busy. Streaming will give them easy access to games without hassle	ESPN has worked to extend its influence throughout sports and entertainment. It holds broadcasting contracts with different leagues.	NCAA shows different sports in order to expose its brand.	The college websites try to show the games to increase support for the institution and to expose the name of the college.
	Accessibility and Low cost	It is one of the strongest companies in the area and it is already well recognized	It has all the rights for transmission.	Colleges are responsible for the athletes.
	IT use, extended knowledge of teams	It has an extend knowledge and network of how to do business.	It holds and runs all the tournaments.	College websites have the strength of knowing the athletes and the institution.
	Start up, small company, small fan base, unpredictability of technology	t does not focus a lot on colleges sports, and it lacks in covering all the sports.	t does not give enough information and it does not cover the different sports in the same way.	It does not have an extend knowledge of how to do business.

Student Team Competitive Analysis

	Blue Sky	Southwest	Delta
Bags and Carry On Fees	No extra fees for multiple bag checks and carry ons.	No extra fees for multiple bag checks and carry ons.	- \$30 for your first checked bag under 50lbs. - \$40 for your second checked bag under 50lbs.
Fleet Numbers	- Operates a fleet of 800+ aircraft - Wide variety of aircraft	- Operates a fleet of 700+ aircraft - Focuses solely on Boeing 737	- Operates a fleet of 700+ aircraft - Wide Variety of aircraft
Major Operating Bases	Atlanta, Los Angeles, New York, and Dallas	Atlanta and Los Angeles	Atlanta and Los Angeles
International Network System	Flights available in 60+ countries	Flights available in 10 countries	Flights available in just over 50 countries
App and Web Accessible	- Tickets can be easily purchased both on our website and our mobile app. - You can sign up for your free Blue Sky Rewards Program on our mobile app in which you can manage any rewards or benefits you receive for flying with us	Tickets can be ordered on the Southwest.com or through their mobile app	Tickets can be ordered on Delta.com or through their mobile app
Frequent Flyer Program	- Blue Sky Rewards Club - 1 mile = 1.55 cents - Miles can be redeemed at 2,000 miles which = \$31 - 3 tier system - No black out dates - Points do not expire - Points can be redeemed for flights or for other rewards	- Southwest Rapid Rewards - 1 mile = 1.65 cents - Miles can only be redeemed at 1,000 miles which = \$16.5 - 3 Levels of membership - No black out dates - Points do not expire - Points can be redeemed for flights or for other rewards	- Delta SkyMiles - 1 mile = 1 cent - Miles can only be redeemed at 5,000 miles which = \$50 - 4 tier system - Points or Skymiles can be redeemed for flights or for other rewards - Points do not expire

Porter's Value Chain Model



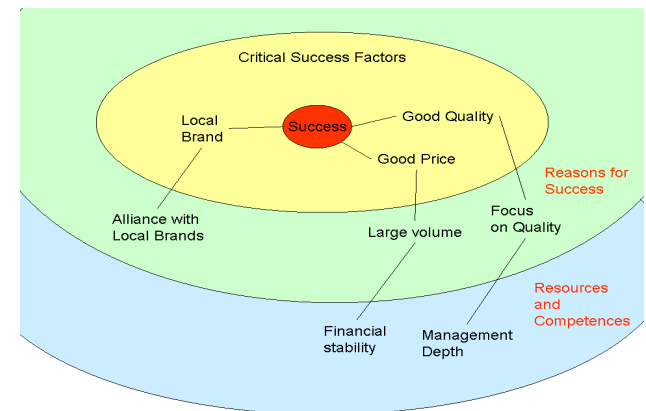
Critical Success Factors

[another view of strategic advantage]

- *Wikipedia* - **Critical Success Factor** (CSF) or Critical Success Factors is a business term for an element which is necessary for an organization or project to achieve its mission
- The concept of "success factors" was developed by D. Ronald Daniel of McKinsey & Company in 1961
- The process was refined by Jack F. Rockart in 1986
- In 1995 James A. Johnson and Michael Friesen applied it to many business sector settings
 - Something that an organization must do well to thrive in its primary business sector

Common CSF's

- **Money factors**: positive cash flow, revenue growth, and profit margins
- **Growth** - acquiring new customers and/or distributors -- your future
- **Customer satisfaction/loyalty** -- how happy are they?
- **Quality** -- how good is your product and service?
- **Product/service research and development** -- what's new that will increase business with current customers and attract new ones?
- **Strategic relationships** -- new sources of business, products and outside revenue
- **Employee** attraction and retention -- your ability to do extend your reach
- **Management experience and quality**
- **Investor commitment**
- **Supplier stability**



Student Team CSF's



IT & CSF's

- How can IT positively influence each CSF ?

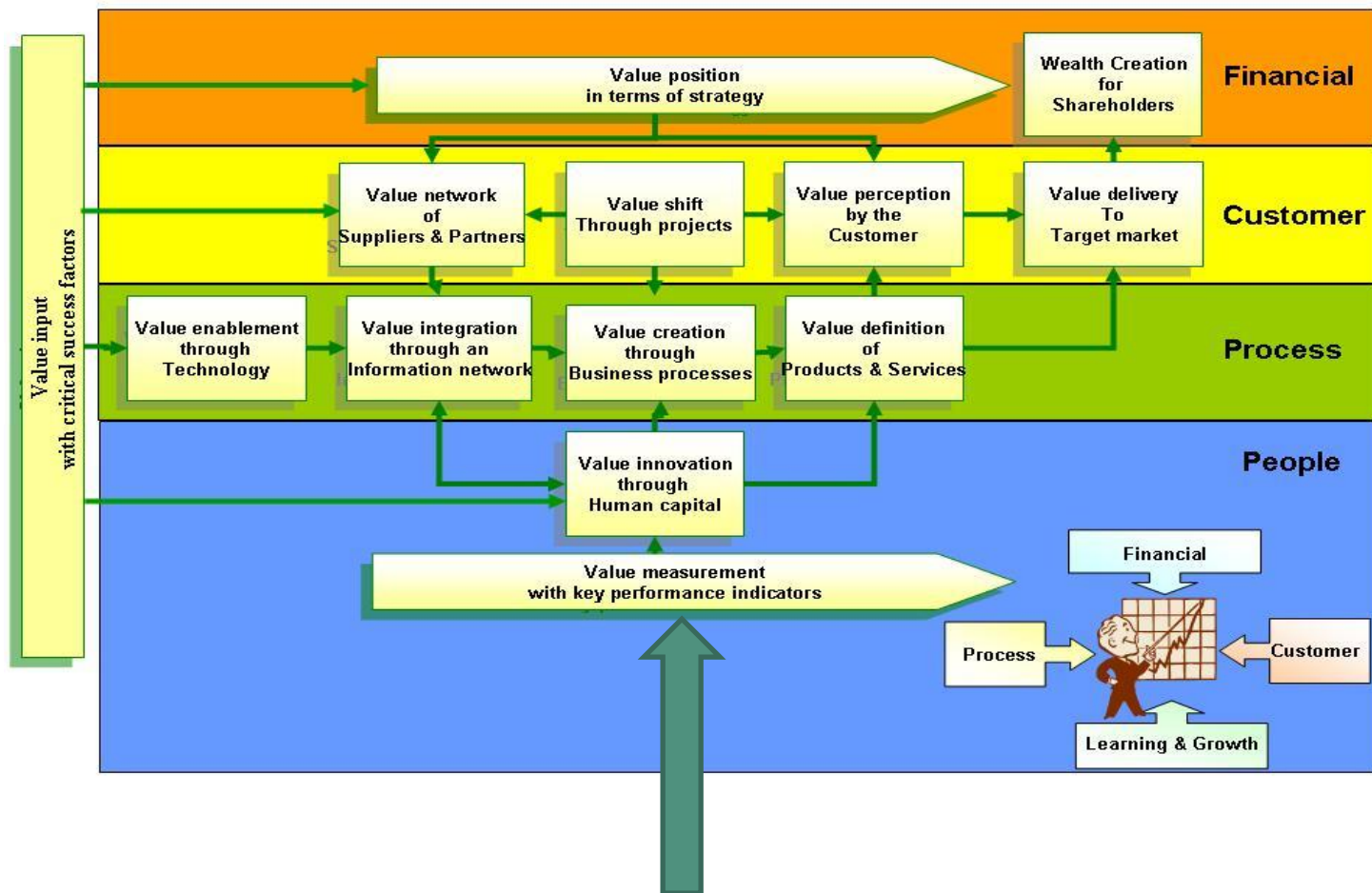


The “Amazon Way”



- **1. Obsess over customers, not competitors**
- **2. Take risks for market leadership**
- **3. Make employees think like owners**
 - We will continue to focus on hiring and retaining versatile and talented employees, and continue to weight their compensation to stock options rather than cash
- **4. Build a culture that's right for your company**
 - Amazon's own culture is famously breakneck-paced, and notoriously cost-conscious, as befits a company that has run only a small profit, or a loss, under generally accepted accounting principles for most of its life as a public company
- **5. Empower people — up to a point — to avoid bureaucracy**
 - Bezos argues that there are two kinds of decisions: Irreversible turning points he calls "Type 1 decisions" that top executives should be involved in and a larger number of tactical calls he calls "Type 2 decisions" that a business can reverse if it gets wrong.
 - "Type 2 decisions can and should be made quickly by high judgment individuals or small groups," Bezos wrote in the 2015 letter. "As organizations get larger, there seems to be a tendency to use the heavy-weight Type 1 decision-making process on most decisions, including many Type 2 decisions."

Adding **VALUE** & Key Performance Indicators (KPI)



Efficiency, Effectiveness, and Value

Efficiency

- Doing something at the lowest possible cost and/or fastest time

Effectiveness

- Doing the right things to create the most value for your customer

Value (quality divided by price; where quality is features, enjoyment, useful life, support)

- The attractiveness of a product relative to its cost

Efficiency and Financial Ratios

- Comparison of firms is important to investors
 - ▣ From an operations and supply chain perspective, the relative cost of providing a good or service is closely related to earnings growth
- Management efficiency ratios
 - ▣ Labor productivity
 - Net income per employee
 - Revenue (or sales) per employee
 - ▣ Asset productivity
 - Receivables turnover ratio = $\frac{\text{Annual Credit Sales}}{\text{Average Accounts Receivables}}$
 - Inventory turnover = $\frac{\text{Cost of goods sold}}{\text{Average Inventory Value}}$
 - Asset turnover = $\frac{\text{Revenue (or Sales)}}{\text{Total Assets}}$

A COMPARISON OF AUTOMOBILE COMPANIES

EFFICIENCY MEASURE	TOYOTA (TM)	GENERAL MOTORS (GM)	FORD (F)	INDUSTRY
Income per employee	\$13,694	\$25,075	\$39,982	\$17,545
Revenue (or sales) per employee	\$756,669	\$671,248	\$786,305	\$550,751
Receivables turnover	12.8	16.7	17.7	10.8
Inventory turnover	12.2	10.7	19.9	9.5
Asset turnover	0.7	1.0	0.7	0.8

Gross Margin

A company's total sales **revenue** minus its **cost of goods sold**, divided by the total sales revenue, expressed as a percentage. The gross margin represents the percent of total sales revenue that the company retains after incurring the direct costs associated with producing the goods and services sold by a company. The higher the percentage, the more the company retains on each dollar of sales to service its other costs and obligations.

$$\text{Gross Margin (\%)} = \frac{\text{Revenue} - \text{Cost of Goods Sold}}{\text{Revenue}}$$

This number represents the proportion of each dollar of revenue that the company retains as gross profit. For example, if a company's gross margin for the most recent quarter was 35%, it would retain \$0.35 from each dollar of revenue generated, to be put towards paying off selling, general and administrative expenses, interest expenses and distributions to shareholders. The **levels of gross margin** can vary drastically from one industry to another depending on the business. For example, software companies will generally have a much higher gross margin than a manufacturing firm.

Current Ratio

The **current ratio** is a **financial ratio** that measures whether or not a firm has enough resources to pay its debts over the next 12 months. It compares a firm's **current assets** to its **current liabilities**. It is expressed as follows:

$$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

The current ratio is an indication of a firm's **market liquidity** and ability to meet creditor's demands. Acceptable current ratios vary from industry to industry and are generally between 1.5 and 3 for healthy businesses. If a company's current ratio is in this range, then it generally indicates good short-term financial strength. If current liabilities exceed current assets (the current ratio is below 1), then the company may have problems meeting its short-term obligations. If the current ratio is too high, then the company may not be efficiently using its current assets or its short-term financing facilities. This may also indicate problems in **working capital** management.

Low values for the current or quick ratios (values less than 1) indicate that a firm may have difficulty meeting current obligations. Low values, however, do not indicate a critical problem. If an organization has good long-term prospects, it may be able to borrow against those prospects to meet current obligations. Some types of businesses usually operate with a current ratio less than one. For example, if inventory turns over much more rapidly than the accounts payable become due, then the current ratio will be less than one. This can allow a firm to operate with a low current ratio.

If all other things were equal, a creditor, who is expecting to be paid in the next 12 months, would consider a high current ratio to be better than a low current ratio, because a high current ratio means that the company is more likely to meet its liabilities which fall due in the next 12 months. You should view the relation between the operation cycle period and the current ratio.

P/E (price-earnings) Ratio

A valuation ratio of a company's current share price compared to its per-share earnings.

Calculated as:

Market Value per Share / Earnings per Share (EPS)

For example, if a company is currently trading at \$43 a share and earnings over the last 12 months were \$1.95 per share, the P/E ratio for the stock would be 22.05 ($\$43 / \1.95).

EPS is usually from the last four quarters (trailing P/E), but sometimes it can be taken from the estimates of earnings expected in the next four quarters (projected or forward P/E). A third variation uses the sum of the last two actual quarters and the estimates of the next two quarters.

Return on Equity

The amount of net income returned as a percentage of shareholders equity. Return on equity measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested.

ROE is expressed as a percentage and calculated as:

Return on Equity = Net Income/Shareholder's Equity

Net income is for the full fiscal year (before dividends paid to common stock holders but after dividends to preferred stock.) Shareholder's equity does not include preferred shares.

Also known as "return on net worth" (RONW).

Return on Capital

Return on capital (ROC) is a ratio used in finance, valuation, and accounting. The ratio is estimated by dividing the after-tax operating income (NOPAT) by the [book value of invested capital](#). It is a useful measure for comparing the relative profitability of companies after taking into account the amount of capital used.^[1]

Contents [\[hide\]](#)

[1 Formula](#)

[2 ROIC formula](#)

[3 See also](#)

[4 References](#)

Formula [\[edit\]](#)

$$\bullet \text{ ROC} = \frac{\text{NetOperatingProfit} - \text{AdjustedTaxes}}{\text{BookValueOfDebt} + \text{BookValueOfEquity} - \text{Cash}}$$

When the return on capital is greater than the [cost of capital](#) (usually measured as the [weighted average cost of capital](#)), the company is creating value; when it is less than the cost of capital, value is destroyed.^[1]

This differs from ROIC. **Return on invested capital (ROIC)** is a financial measure that quantifies how well a company generates cash flow relative to the capital it has invested in its business. It is defined as [net operating profit less adjusted taxes](#) divided by [invested capital](#) and is usually expressed as a [percentage](#). In this calculation, capital invested includes all monetary capital invested: long-term debt, common and preferred shares.

ROIC formula [\[edit\]](#)

$$\bullet \text{ ROIC} = \frac{\text{NetOperatingProfit} - \text{AdjustedTaxes}}{\text{InvestedCapital}}$$

Note that the numerator in the ROIC fraction does not subtract [interest expense](#), because the return is calculated for total capital, and not only equity capital.^[1]

Return on Assets (Investment)

[ROI]

An indicator of how profitable a company is relative to its total assets. ROA gives an idea as to how efficient management is at using its assets to generate earnings. Calculated by dividing a company's annual earnings by its total assets, ROA is displayed as a percentage. Sometimes this is referred to as "return on investment".

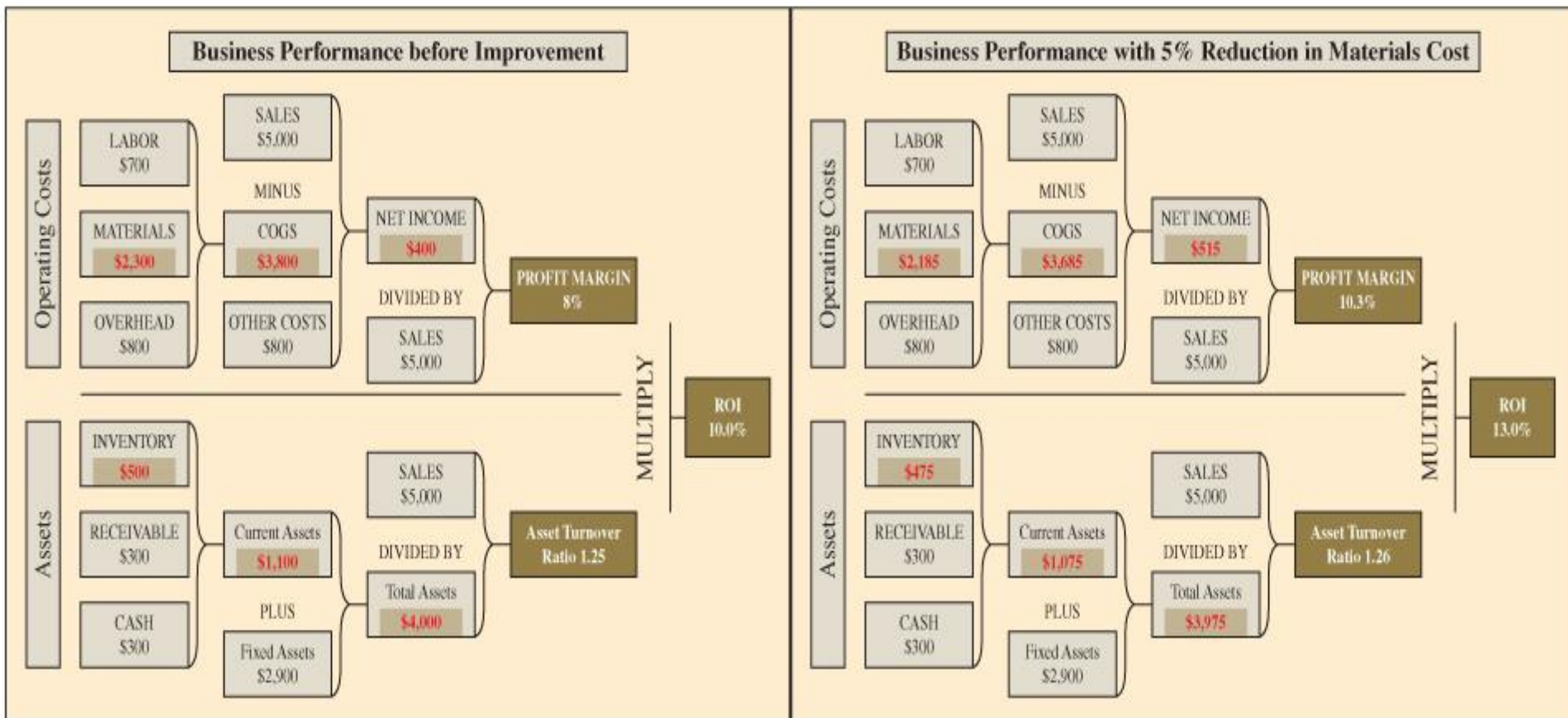
The formula for return on assets is:

$$= \frac{\text{Net Income}}{\text{Total Assets}}$$

Note: Some investors add interest expense back into net income when performing this calculation because they'd like to use operating returns before cost of borrowing.

Impact of Reducing Material Costs

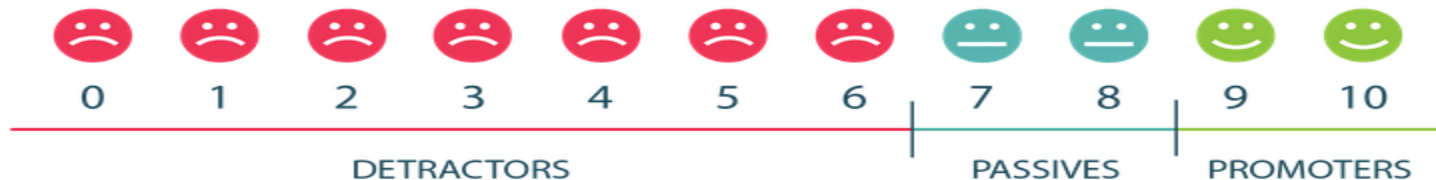
[ROI, ROA = Net Income / Total Assets]



A 5% reduction in material costs, results in a 30% increase in ROI !

Net Promoter Score (NPS)

- New measure of customer sentiment
- Used by 2/3 of Fortune 500 companies
- Question based:
 - On a scale of zero to ten: How likely is it that you would recommend ABC Company to a friend or colleague ?
 - Detractors, Passives, Promoters
 - Often expressed as emoticons on dashboards



$$\text{😊 \%} - \text{😞 \%} = \text{NET PROMOTER SCORE}$$

NPS (con't)



NPS Leaders

INDUSTRY	LOWEST	AVERAGE	HIGHEST
RETAIL BANKING	16	34	78 USAA
CREDIT CARDS	11	38	67 DISCOVER
PROPERTY & CASUALTY INSURANCE	-18	30	70 USAA
WEALTH MANAGEMENT	18	34	63 VANGUARD
WIRED NETWORK OPERATIONS	-31	-7	23 VERIZON FIOS
WIRELESS SERVICE (POSTPAID)	3	33	58 CONSUMER CELLULAR
DEPARTMENT STORES	29	36	42 NORDSTROM
GROCERY STORES	-1	29	69 H-E-B
DRUGSTORES	-20	-12	-4 WALGREENS
QUICK SERVICE & FAST-CASUAL RESTAURANTS	2	21	60 CHICK-FIL-A

FEDEX & IT



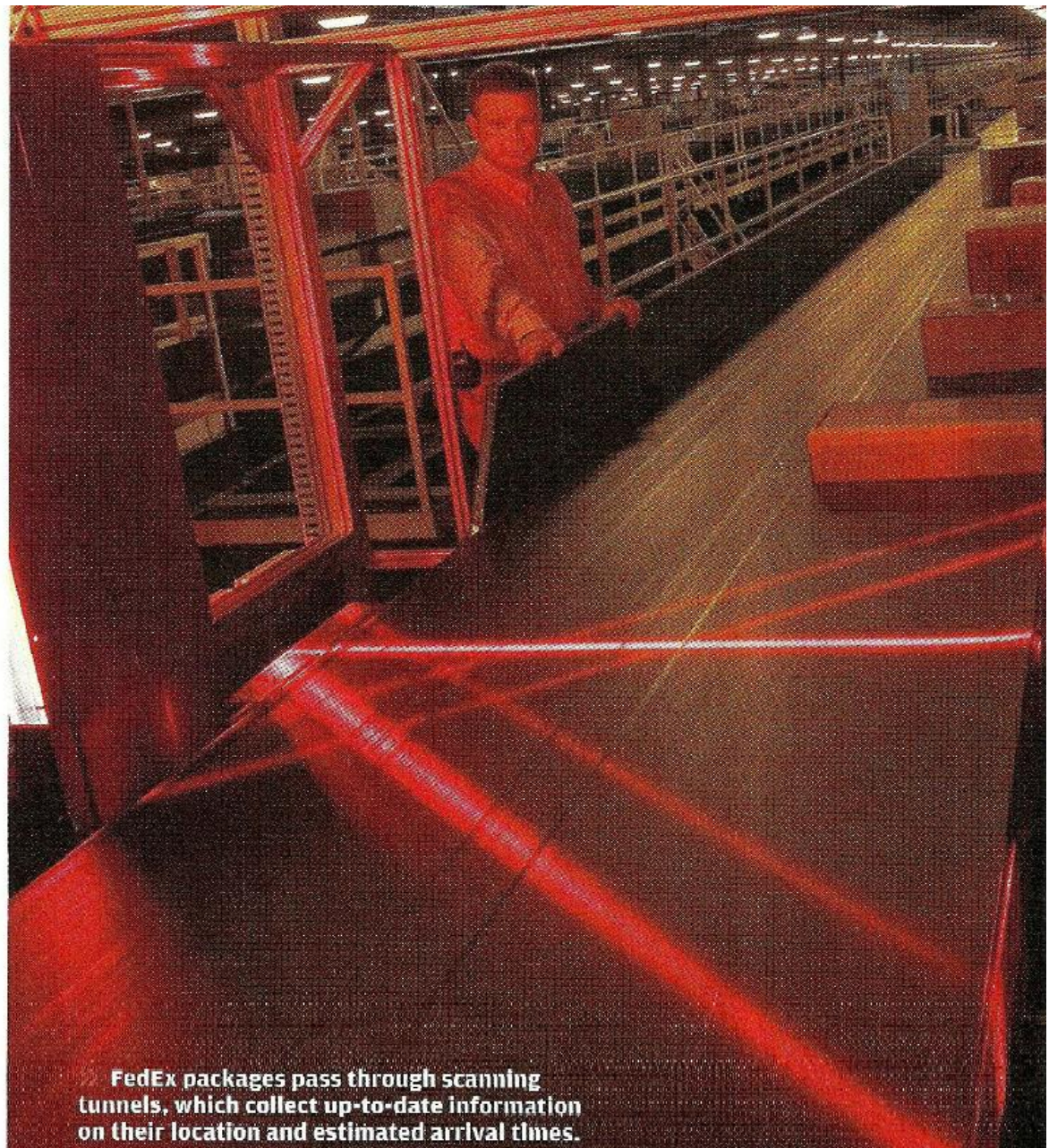
» At FedEx hubs, a sorting system controls where and when to divert moving packages, based on data recorded by scanners above the conveyor belts.

The scans record each package's physical dimensions, weight and destination ZIP code, plus other information, such as where the package is at any given moment, whether in the hub or en route to its destination.

At the hub, "after a package is unloaded from a trailer, the next time it is touched by human hands is at the loading dock," says Ken Spangler, a senior vice president and CIO at FedEx Ground, a \$7 billion unit of FedEx Corp. "Everything in between is automated."

And "everything in between" — such as the routing of the package — can also be changed on the fly. But it all happens at lightning speed, and that's critical because winning market share in the ultra-competitive \$31 billion domestic ground package-delivery business comes down to a matter of milliseconds.

"Over the last five years, we have been on a mission to get faster and faster," Spangler says. "We re-engineer and speed up our lanes an average of twice a year, and sometimes more frequently than that. Over 80,000 ZIP-code-to-ZIP-code lanes are at least a day faster now." As a result, the company's ground service is able to deliver in a single business day almost a quarter of the 3.5 million packages it handles daily. Most packages — about 85% — are delivered within three business days.



FedEx packages pass through scanning tunnels, which collect up-to-date information on their location and estimated arrival times.

FEDEX Roxo

- Roxo operates on sidewalks, bike lanes and roadsides, and is designed to be used in a three-to-five mile radius of a retailer's location
- Roxo is for reliable, autonomous last-mile delivery that can deliver to a customer's door, including climbing the curb, traveling up the sidewalk and climbing deep terrace steps



FEDEX Shopchain

- In direct competition with Amazon, a trademark has been requested for “FedEx Shopchain”
- It for a program that enables shoppers to get free shipping for online orders, as well as a program that allows retailers and merchants to monitor and manage customer preferences, customer identity, customer profiles, online sales transactions, and online shopping carts
- There will be a universal online shopping cart, and available inventory and fulfillment planning

Innovation Example - Nextbite

FOOD NEWS



MARC FISCOTTY

'Virtual kitchen' concept enters Memphis market

Denver-based Nextbite partners with restaurants to fulfill orders based around set recipes

Geoff Madding, CEO of Nextbite, defines the concept as a "virtual kitchen." He has a background in restaurants and startups and combined the two to start Nextbite, which recently entered Memphis.

The company began as an outgrowth of Ordermark, which consolidates the ordering process for restaurants using third-party delivery companies such as GrubHub and UberEats. Those companies give the restaurants individual tablets for processing orders. With

Ordermark, one tool is used.

"The same technology cannot just aggregate orders, it can also allow you to spin up a virtualized restaurant," he said.

Nextbite partners with restaurateurs who fulfill orders based around the concepts and recipes provided by Nextbite.

Among its 12 concepts are The Big Melt (patty melts); Monster Mac (mac and cheese); TossItUp (salads); and Mother Clucker (chicken).

In the Memphis area, Grilled

Cheese Society, Outlaw Burger, and Mother Clucker – all Nextbite concepts – are run out of a kitchen at 1525 Airways Blvd. Nextbite is based out of Denver and was formed about four years ago.

"We create all the recipes and we provide all the training," Madding said. "We let you use your existing supplier. We spec out all those different suppliers so that you can continue to order through your existing supply chain."

It's designed so that restaurateurs can continue to operate their own restaurants while making extra money by working with Nextbite.

But, Madding is careful to say that Nextbite is not a franchise.

"I want to be really careful with that, because we do not franchise," he said. "We have what we call fulfillment partners. There's a lot that goes into franchising. It's long-term contracts; it's long-term commitments; there's usually a lot of capital involved. That is not the way we are. We have partners who have signed a contract with us and within 16 days have been fulfilling orders out of their restaurants. Our contracts are all month to month. There are no long-term commitment. There are no upfront or ongoing fees."

Nextbite is currently in 40 states. Madding said that, ultimately, it's pro-restaurant.

"This has kept them alive now, which is great," he said. "It's doing what it's intended to do. Our intention was always to design the solution to be flexible, to be lightweight, to be an add-on to their existing business. The smart restaurateurs out there going forward, the ones that make it through this tough time are going to be the ones who have figured out how to really maximize their space, have figured out how to maximize their different delivery, and to maximize the relationship with their customers."

— Susan Ellis

Innovation Example - Narrativ

- Li Chen was working at a fashion brand when she realized that authentic reviews outperformed ads

The screenshot shows the Narrativ website. The navigation bar includes links for PRODUCTS, PARTNERS, PRESS, NARRATIV (highlighted), CAREERS, SIGN IN, and a GET A DEMO button. Below the navigation bar, a section titled 'THE PRODUCT RECOMMENDATION ECONOMY IS BOOMING' is displayed. The text states: 'Product recommendation is *the* way a new generation of shoppers find the best products.' and 'Every month, billions of consumers search for honest product reviews from experts like The New York Times to YouTube creators. Narrativ's technology gives brands access to this \$40B economy that's been monopolized by Amazon to date.'

To the right of the text is a diagram illustrating the product recommendation economy. It features a central cluster of yellow circles, each containing a logo and associated statistics:

- Gen Z** (pink box): TikTok (88B views on shopping posts), Twitch.
- Millennial** (pink box): Google, YouTube (50,000 years of product reviews watched), Pinterest.
- Gen X** (pink box): Consumer Reports, The New York Times, Condé Nast, Business Insider, Hearst, Meredith, Facebook, Instagram.

Innovation Example - Resonance

■ Fashion design manufacturing outsourcing



Innovation Example - Tempo Studio



Amazon Jobs

- Amazon is hosting career days around the US as part of a goal to hire around thousands of positions across the country
- Here are top [job categories available](#), and what similar types of positions pay, according to national estimates from the Bureau of Labor Statistics
 - **Software Development** – 9,003 jobs available
 - Median yearly income for software development engineers: \$110,000.
 - **Project / Program / Product Management** – 3,733 jobs available, in technical and non-technical roles
 - Median yearly income for computer and information systems managers: \$142,530. Median income for operations managers: \$100,930.
 - **Solutions Architects** – 2,797 jobs available
 - Median income for computer network architects: \$109,020.
 - **Operations, IT, and Support Engineering** – 2,052 jobs available
 - Median income for data center network technicians: \$82,050.
 - **Business and Merchant Development** – 932 jobs available
 - Median income for business operations specialists: \$70,530.
 - **Business Intelligence** – 722 jobs available
 - Median income for economists: \$104,340. Statisticians: \$87,780. Financial analysts: \$85,660.
 - **Supply Chain Management** – 509 jobs available
 - Median income for transportation, storage and distribution managers: \$94,730.

Library and Web References

- [Modern Database Management \(8th Edition\)](#) by Jeffrey A. Hoffer, Mary Prescott, and Fred McFadden
- [Database Development for Dummies](#) by Allen G. Taylor
- [Database Systems: Design, Implementation, and Management, Seventh Edition](#) by Peter Rob and Carlos Coronel
- [Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design, Second Edition](#) by Michael J. Hernandez
- [Beginning Database Design: From Novice to Professional](#) by Clare Churcher
- [Database Modeling and Design: Logical Design, 4th Edition \(The Morgan Kaufmann Series in Data Management Systems\)](#) by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau
- [Oracle9i for Dummies](#) by Carol McCullough-Dieter and Ned Dana

Homework

- Textbook Chapter Three
- Quiz on this lesson and that chapter
- Appendix: Potential billion dollar startups and innovation award winners
 - Possibly some ideas for team project
- Individually for ABC:
 - Competitive analysis
 - Critical success factors
 - Strategic use of IT
 - Should update this report as you progress thru the course

Potential Billion Dollar Startups

CHAINALYSIS

FOUNDERS: **MICHAEL GRONAGER (CEO), JONATHAN LEVIN, JAN MOLLER**; EQUITY RAISED: **\$53 MILLION**; ESTIMATED 2018 REVENUE: **\$8 MILLION**; LEAD INVESTORS: **ACCEL, BENCHMARK**

WHAT IT DOES: Software that helps businesses and governments learn who is using cryptocurrency and how, helping prevent money laundering and investigating alleged criminals.



DAVE

FOUNDERS: **PARAS CHITRAKAR, JASON WILK (CEO), JOHN WOLANIN**; EQUITY RAISED: **\$13 MILLION**; ESTIMATED 2018 REVENUE: **\$19 MILLION**; LEAD INVESTORS: **MARK CUBAN, SECTION 32**

WHAT IT DOES: Personal finance app that helps users predict upcoming expenses and avoid overdraft fees. It's been downloaded nearly 10 million times in two years.

CYBEREASON

FOUNDERS: **LIOR DIV (CEO), YOSSI NAAR, YONATAN STRIEM-AMIT**; EQUITY RAISED: **\$189 MILLION**; ESTIMATED 2018 REVENUE: **\$50 MILLION**; LEAD INVESTORS: **CRV, LOCKHEED MARTIN, SOFTBANK, SPARK CAPITAL**

WHAT IT DOES: Cloud-based system to protect companies against advanced cyber-security attacks. It was launched by friends from Israel Defense Forces' elite intelligence unit, Unit 8200.



DIVVY

FOUNDERS: **BLAKE MURRAY (CEO), ALEX BEAN**; EQUITY RAISED: **\$257 MILLION**; ESTIMATED 2018 REVENUE: **\$8 MILLION**; LEAD INVESTORS: **INSIGHT PARTNERS, NEW ENTERPRISE ASSOCIATES, PELION VENTURE PARTNERS**

WHAT IT DOES: A different way of filing corporate expenses. Its software, which includes proactive fraud detection and real-time spend monitoring, is free. It makes money by giving businesses custom Mastercards and taking a cut of merchants' fees to the bank.



DUOLINGO

FOUNDERS: LUIS VON AHN (CEO), SEVERIN HACKER; **EQUITY RAISED:** \$108 MILLION; **ESTIMATED 2018 REVENUE:** \$36 MILLION; **LEAD INVESTORS:** CAPITALG, KLEINER PERKINS, UNION SQUARE VENTURES

WHAT IT DOES: The world's most popular digital language-learning tool, seven-year-old Duolingo has 28 million monthly active users. Most use the free version of its gamified courses. Revenue, largely from subscription fees from ad-free Duolingo Plus, is expected to double this year.

FAIRE

FOUNDERS: MARCELO CORTES, DANIELE PERITO, MAX RHODES (CEO); **EQUITY RAISED:** \$116 MILLION; **ESTIMATED 2018 REVENUE:** \$100 MILLION; **LEAD INVESTORS:** FORERUNNER VENTURES, KHOSLA VENTURES, LIGHTSPEED VENTURE PARTNERS, Y COMBINATOR

WHAT IT DOES: Helps mom-and-pop stores discover and try new products. Faire is trying to take the risk out of wholesale purchasing by allowing retailers to buy inventory online and return it within 60 days if it doesn't sell.

FIGMA

FOUNDERS: DYLAN FIELD (CEO), EVAN WALLACE; **EQUITY RAISED:** \$83 MILLION; **ESTIMATED 2018 REVENUE:** \$3 MILLION; **LEAD INVESTORS:** GREYLOCK, INDEX VENTURES, KLEINER PERKINS, SEQUOIA

WHAT IT DOES: Google Docs, but for designers. Figma's browser-based tool, used by firms like Microsoft and Volvo, lets designers work online and with colleagues across an organization.



FOURKITES

FOUNDERS: ARUN CHANDRASEKARAN, MATT ELENJICKAL (CEO); **EQUITY RAISED:** \$101 MILLION; **ESTIMATED 2018 REVENUE:** \$16 MILLION; **LEAD INVESTORS:** AUGUST CAPITAL, BAIN CAPITAL VENTURES, HYDE PARK VENTURE PARTNERS

WHAT IT DOES: Predictive supply-chain management. FourKites tracks shipment locations, temperature and potential delays on upwards of 500,000 loads per day for customers that include Best Buy, Kraft Heinz, Nestlé and Smithfield Foods.



FRONT

FOUNDERS: MATHILDE COLLIN (CEO), LAURENT PERRIN; **EQUITY RAISED:** \$79 MILLION; **ESTIMATED 2018 REVENUE:** \$16 MILLION; **LEAD INVESTORS:** SEQUOIA, UNCORK CAPITAL

WHAT IT DOES: Front's shared email inbox encourages team collaboration, helping companies become more productive. Its 5,000 customers include Shopify, MailChimp and Stripe.

ROTHY'S

FOUNDERS: STEPHEN HAWTHORNTHWAITTE, ROTH MARTIN (INTERIM CEO); **EQUITY RAISED:** \$42 MILLION; **ESTIMATED 2018 REVENUE:** \$140 MILLION; **LEAD INVESTORS:** GOLDMAN SACHS, LIGHTSPEED VENTURE PARTNERS

WHAT IT DOES: Designs and manufactures eco-friendly, 3-D knitted round-toe and point-toe flats made from recycled plastic water bottles.



TRUEPILL

FOUNDERS: UMAR AFRIDI (CEO), SID VISWANATHAN; **EQUITY RAISED:** \$13 MILLION; **ESTIMATED 2018 REVENUE:** \$48 MILLION; **LEAD INVESTOR:** INITIALIZED CAPITAL

WHAT IT DOES: Behind-the-scenes pharmacy that fills and delivers medications for the growing number of direct-to-consumer startups, including Nurx (birth control), Hims (hair loss, erectile dysfunction), Apostrophe (acne, male pattern baldness) and others.

SIGNALFX

FOUNDERS: PHILLIP LIU, KARTHIK RAU (CEO); **EQUITY RAISED:** \$179 MILLION; **ESTIMATED 2018 REVENUE:** \$25 MILLION; **LEAD INVESTORS:** ANDREESSEN HOROWITZ, CRY, GENERAL CATALYST, TIGER GLOBAL MANAGEMENT

WHAT IT DOES: A real-time cloud monitoring platform for companies' infrastructure and applications. While competitors collect and query data in batches in two to three minutes, SignalFX evaluates and alerts users to anomalies in two to five seconds.



VERKADA

FOUNDERS: BENJAMIN BERCOVITZ, FILIP KALISZAN (CEO), JAMES REN, HANS ROBERTSON; **EQUITY RAISED:** \$69 MILLION; **ESTIMATED 2018 REVENUE:** \$20 MILLION; **LEAD INVESTORS:** FIRST ROUND, MERITECH, NEXT47, SEQUOIA

WHAT IT DOES: Cloud-based enterprise video security makes it easy to set up cameras and share streams of potential security breaches and threats.



SYNTHEGO

FOUNDERS: PAUL DABROWSKI (CEO), MICHAEL DABROWSKI; **EQUITY RAISED:** \$157 MILLION; **ESTIMATED 2018 REVENUE:** \$20 MILLION; **LEAD INVESTORS:** FOUNDERS FUND, BVC

WHAT IT DOES: Produces tools that researchers in the academic and private sectors can use to accelerate the development of gene-edited technologies such as new medical treatments.



PATREON

FOUNDERS: JACK CONTE (CEO), SAM YAM; **EQUITY RAISED:** \$106 MILLION; **ESTIMATED 2018 REVENUE:** \$35 MILLION; **LEAD INVESTORS:** FREESTYLE CAPITAL, INDEX VENTURES, THRIVE CAPITAL

WHAT IT DOES: A membership platform where artists offer exclusive experiences to their subscribers or "patrons" in return for contributions.



PROXY

FOUNDERS: DENIS MARS (CEO), SIMON RATNER; **EQUITY RAISED:** \$14 MILLION; **2018 REVENUE:** \$1 MILLION; **LEAD INVESTOR:** KLEINER PERKINS

WHAT IT DOES: A Bluetooth-enabled app that's like having a set of keys on your smartphone. It currently replaces traditional access cards for offices, businesses and multifamily homes, and could eventually be used for ride-sharing and event check-in.



REDIS LABS

FOUNDERS: OFER BENGAL (CEO), YIFTACH SHOOLMAN; **EQUITY RAISED:** \$147 MILLION; **ESTIMATED 2018 REVENUE:** \$50 MILLION; **LEAD INVESTORS:** BAIN CAPITAL VENTURES, FRANCISCO PARTNERS, GOLDMAN SACHS, VIOLA VENTURES

WHAT IT DOES: Israeli tech veterans Ofer Bengal and Yiftach Shoolman set up Redis Labs, a fast-database service, in 2011. That lightning-fast processing speed has helped it sign on FedEx, Mastercard and other corporate behemoths.

REMITLY

FOUNDERS: SHIVAAS GULATI, JOSH HUG, MATT OPPENHEIMER (CEO); **EQUITY RAISED:** \$177 MILLION; **ESTIMATED 2018 REVENUE:** \$80 MILLION; **LEAD INVESTORS:** BEZOS EXPEDITIONS, DFJ VENTURE CAPITAL, NASPERS' PAYU, QED INVESTORS, STRIPES GROUP

WHAT IT DOES: Money-transfer service. Remitly lets people in developed nations like the U.S. and Australia send money cheaply to relatives in developing countries like Mexico and the Philippines.



RIGUP

FOUNDERS: XUAN YONG (CEO), MIKE WITTE; **EQUITY RAISED:** \$94 MILLION; **ESTIMATED 2018 REVENUE:** \$21 MILLION; **LEAD INVESTORS:** BEDROCK CAPITAL, FOUNDERS FUND, QUANTUM ENERGY PARTNERS

WHAT IT DOES: Online marketplace for on-demand services and labor in the oil and energy industry. Think Uber for the oilfield.



FUBOTV

FOUNDERS: SUNG HO CHOI, DAVID GANDLER (CEO), ALBERTO HORIHUELA; **EQUITY RAISED:** \$145 MILLION; **ESTIMATED 2018 REVENUE:** \$74 MILLION; **LEAD INVESTORS:** 21ST CENTURY FOX, NORTHZONE, SKY

WHAT IT DOES: This cable-replacement service streams live TV, with an emphasis on sports programming. Started to tap into pent-up demand in the U.S. for overseas soccer leagues, FuboTV has expanded to become a cheaper alternative to cable with more than 90 channels.



LATTICE

FOUNDERS: JACK ALTMAN (CEO), ERIC KOSLOW; **EQUITY RAISED:** \$27 MILLION; **ESTIMATED 2018 REVENUE:** \$7 MILLION; **LEAD INVESTORS:** SHASTA VENTURES, THRIVE CAPITAL

WHAT IT DOES: Performance management software that uses surveys to promote employee engagement and career development. Its 1,300 customers include Coinbase, Instacart, Slack and WeWork.

GROVE COLLABORATIVE

FOUNDERS: CHRIS CLARK, STUART LANDEBERG (CEO), JORDAN SAVAGE; **EQUITY RAISED:** \$213 MILLION; **ESTIMATED 2018 REVENUE:** \$104 MILLION; **LEAD INVESTORS:** BULLPEN CAPITAL, GENERAL ATLANTIC, LONE PINE VENTURES, MAYFIELD FUND, NORWEST VENTURE PARTNERS, SERIOUS CHANGE

WHAT IT DOES: Online seller of natural home and personal care products. Grove works with manufacturers like Method and Seventh Generation and has also developed its own sustainable product line.



KONG

FOUNDERS: AUGUSTO MARIETTI (CEO), MARCO PALLADINO; **EQUITY RAISED:** \$71 MILLION; **ESTIMATED 2018 REVENUE:** \$5 MILLION; **LEAD INVESTORS:** ANDRESEN HOROWITZ, CRV, INDEX VENTURES, NEW ENTERPRISE ASSOCIATES

WHAT IT DOES: Kong acts as a gatekeeper to companies' APIs (which code developers use to build apps), and monitors how often they're used.



NEXT TRUCKING

FOUNDERS: ELTON CHUNG, LIDIA YAN (CEO); **EQUITY RAISED:** \$125 MILLION; **ESTIMATED 2018 REVENUE:** \$46 MILLION; **LEAD INVESTORS:** BROOKFIELD VENTURES, CHINA ENERGY GROUP, SEQUOIA

WHAT IT DOES: Connects shippers and truckers to solve the "first-mile" delivery challenge: moving goods from port to warehouse. That's a complex problem that online freight startups like Convoy and Uber Freight aren't tackling.



Innovation Award Winners

MARQUES BROWNLEE

Age: 27 • YouTuber

"If you had asked me 10 years ago if I would ever get to 1 million subscribers, I would have said probably not," Brownlee admits. Today, a mere million seems like nothing. More than 12.8 million fans now subscribe to Brownlee's gadget reviews and tech-industry analysis on MK-BHD, his YouTube channel. "It blows my mind every day how many people are actually interested in tech." With his videos attracting 700 million views in the past year, Brownlee earned \$5 million or so. He's come far from his first videos, in which he did things like review the 17-inch HP Pavilion laptop he purchased in high school. Now he's center stage, interviewing such luminaries as Elon Musk, Bill Gates and Mark Zuckerberg.

—Adrian Brown

CHIRAG KULKARNI

Age: 28 • Cofounder, Medly Pharmacy

Tired of long wait times at the pharmacy, Kulkarni set out in 2017 to build a better drugstore along with a pair of second-generation pharmacy owners. "We realized how broken it was for millions of consumers, not just myself," says Kulkarni, now cofounder and CMO of Medly, who has raised \$110 million for the online pharmacy. In addition to same-day prescription delivery, Medly's app connects customers with on-demand pharmacists in a dozen languages. While competitors like Capsule invest in hip branding to entice users, Kulkarni elected to pour marketing bucks into persuading doctors to refer patients to Medly. It's paid off: Medly has served 70,000 patients with more than 500,000 prescriptions, and the company is on track for \$200 million in revenue this year. —Jenny Rooney, Marty Swant and Samantha Todd

Innovation Award Winners (con't)

ALEXANDER LE ROUX

Age: 28 • Co-founder, Icon

While studying at Baylor University, Le Roux had a hunch: "What if 3D printers were a lot bigger? What if we could use concrete?" Now he's the mastermind behind the Vulcan, a nearly 12-foot-tall 3D printer that can make a concrete house in 24 hours for up to 30% cheaper. His startup, Icon, which he founded with over-30-year-olds Evan Loomis and Jason Ballard, used the Vulcan to build America's first permitted compliant 3D-printed home in 2018. Since then it has built 16 more in Austin, Texas, and expanded into Mexico, where Icon is making the world's first 3D-printed community for low-income families. He has raised \$45 million (including from the late Paul Allen's Vulcan Capital) and scored contracts to build barracks for the Defense Department. Icon recently received funding to help NASA figure out how to build structures on the moon. —Elizabeth Brier, Amy Feldman and Alan Ohnsman

BEN SIMMONS

Age: 24 • Point Guard, Philadelphia 76ers

Towering over the basketball court 6 feet, 10 inches—four inches taller than the average NBA player—Philadelphia 76ers star Simmons stands head and shoulders above other pro point guards, a position typically occupied by the shortest guy on the team. "At an early age, I was encouraged to handle the ball and not be pigeonholed into a traditional position," says Simmons, whom the Sixers selected No. 1 in 2016 after notoriously tanking the prior four seasons to win the NBA draft lotto. Now the two-time All-Star's five-year contract is slated to be worth \$175 million (endorsements are worth an other \$6 million annually). He recently added esports company FaZe Clan to his investment portfolio, which already includes a stake in performance technology company Hyperice. "My strategy here is simple: to invest in what I know and believe in," says the gamer. "I think the future of esports is as strong as the NBA's." —Kurt Badenhausen and Christina Settembrino

Innovation Award Winners (con't)

BEN PASTERNAK

Age: 21 • Founder, Simulate

Thanks to Pasternak, vegetarians can feel happier about homemade Happy Meals. His startup, Simulate, makes Nuggs—a vegan version of America's favorite Frankenfood. "Chicken nuggets are already integrated into internet and meme culture," Pasternak says. "It's easy to create a fun brand around it." Based in New York and primarily sold online, Nuggs is on track for \$8 million in revenue this year. The Australia-born Pasternak began building iOS games at 14 and dropped out of school at 15. By 18, he had built and sold Monkey, a video-chat app with 10 million users. Simulate, his latest venture, has raised more than \$15 million from Lerer Hippeau, Alexis Ohanian and McCain Foods. Ever the programmer, Pasternak continually tweaks his plant-based poultry. Nuggs has tested thousands of formulas and released nine versions to the public. Next on the menu? Veggie hot dogs. —Steven Bertoni, Noah Kirsch, Monica Melton and Will Yakowicz

CHAZZ SIMS

Age: 29 • Cofounder, Wise Systems

In a pandemic, logistics are a matter of life and death. After convincing a couple companies to hand over their customer delivery data while at MIT, Sims cofounded Wise Systems in 2014. It uses machine learning to schedule delivery routes and make adjustments in real time to account for traffic, new orders and drivers' current location. "We're solving the old 'cable guy scenario,' where you know you're going to get a package at some point, but you could wait all day," he says. With Wise's software, delivery recipients can know within as little as a 20-minute window when to expect a delivery. Anheuser-Busch is using the software on 750 beer trucks, while Lyft relies on it for scheduling repairs for drivers. The Cambridge, Massachusetts-based startup has \$24 million in venture funding. Says Sims, "We're on a mission to enable perfect deliveries."

—Kenrick Cai, David Jeans and Helen A.S. Popkin

Innovation Award Winners (con't)

CLEMENTINE JACOBY
Age: 29 • Co-founder, Recidiviz

"I left Stanford thinking I would be a professional circus performer," says Jacoby, who spent time teaching acrobatics in a Brazilian gang-diversion program. That experience led her to cofound a company in 2018 that took a more systemic approach to criminal justice reform. Recidiviz aggregates and standardizes fragmented data across prisons, probation and parole. When Covid-19 began sweeping through prisons, North Dakota used Recidiviz to identify those eligible for early release, track their release's impact on public safety and reduce its prison population by 25% in a month. The company has attracted over \$10 million in funding from the likes of Jim Breyer, Bill Ackman and Ashton Kutcher. "We incarcerate more people and for longer than any country in the history of the world," Jacoby says. "And right now, there's bipartisan alignment to unwind mass incarceration." —Igor Bosilkovski and Alexandra Wilson

MADDIE HALL

Age: 28 • Co-founder, Living Carbon

Working with plants is all in the family for Hall. "My grandmother was a botanist," she says. "My mother did flowers and my uncle was a lumberjack." It's no wonder, then, that when Hall herself sought to help fight climate change, her mind would turn to trees. Her company, San Francisco-based Living Carbon, is growing genetically modified poplars and pines capable of absorbing much more carbon dioxide from the atmosphere than regular trees. They also grow faster and produce more durable wood than their natural counterparts. Hall has raised \$6 million to date from the likes of Y Combinator, Sam Altman and Alexis Ohanian. She sees Living Carbon as a Tesla for trees. "Cars geared toward environmentalists were ugly and didn't survive," she says. "But Tesla was cool—and people bought it because of that."

—Katie Jennings, Alex Knapp and Leah Rosenbaum

Innovation Award Winners (con't)

DAN LEYVA

Age: 28 • Co-owner, Wings Over

When he was 19, Leyva faked about his age to land a job at KFC. After graduating high school and then college (at Cornell's elite School of Hotel Administration), both firsts for his Mexican immigrant family, he returned to fast food in 2017. Devastated when his favorite ethnic New York wing spot, Wings Over, closed due to financial problems, Leyva convinced three wealthy college buddies to invest with him for an estimated \$10 million acquisition of the entire franchise. In addition to improving the menu by ditching frozen meat and off-brand items like burgers, Leyva overhauled the 20-year-old chain's online ordering, design and branding. Sales have since grown 20% to over \$50 million, says Leyva, who recently opened his thirty-seventh location, in Linden, New Jersey. "I'm very fortunate that my family has lived the American dream." —Brittany Garrett, Chloe Servino and Kristin Stoller

YANG LIU

Age: 29

Cofounder, End Game Interactive

As a kid, Chinese immigrant Liu didn't have pocket money to spend on a PlayStation, so he made do with free internet browser games. "That shaped the kind of games we're making today," Liu says. End Game Interactive, which he cofounded with Luke Zbilyj in 2018, creates simple but addictive online games. One of its early successes, a 2D multiplayer battle game developed in just four weeks, has attracted 65 million players and will earn over \$4 million in revenue this year. End Game recently raised \$3 million from high-profile investors like Unity Technologies cofounder David Helgason, Twitch cofounder Kevin Lin and talent manager Scooter Braun. Instead of spending "four or five years" on a single game, the company's 20-person team focuses on releasing simpler games faster. "It's just, keep having shots on goal," Liu says.

—Kestrick Cai and Matt Pérez

Innovation Award Winners (con't)

MATT MCCAMBERIDGE
Co-founder, Eden Health

Eden's doctor-in-the-home telemedicine may be all the digital health we need, but the future will be a hybrid of virtual and in-person care. With \$20 million in venture funding, Eden Health provides small to midsize businesses with up to 5,000 virtual visits, 100 lower health care visits, and up to \$800 per employee each year. The key? Employees get their primary care from doctors and staff on Eden's team. By maintaining continuity in treatment through pop-up clinics and app-based virtual consultations, Eden cuts down on unnecessary tests, appointments and high-priced hospital visits. "Access to high-quality health care is a fundamental human right," McCambridge says. "We provide a concierge doctor for every person in our system." —Katie Jennings, *Atlanta Journal-Constitution*

JOOYEON SONG
Age: 29 • Co-founder, ManiMe

A sharp-looking manicure comes at a price, especially for busy young professionals. "It was nearly impossible for me to sit in the nail salon for two hours," says Song, a native of Korea and former BCG consultant. So she and cofounder David Miró Llopis thought of a quicker solution—custom-fit, stick-on gel nails—and started ManiMe in 2017. Consumers simply take a photo of their nails and send it to the Santa Monica-based startup. ManiMe's 3D modeling and laser cutter create a custom fit, starting at just \$15 per set. Revenue is expected to surpass \$3 million this year with salons either closed or seemingly too dangerous during the pandemic. —Alexandra Sterneck and Kristin Tiedt