



Clinical Data

Team leaders:

Afnan Almustafa & Saif Almeshari

Done by:

Khalid Aldosari

Abdullah Alzahrani

Aseel Badukhon

Anas Alsaif

Maha Barakah

Yazeed Alshathry

Revised by:

Yazeed Al-Dossare

clinical data

Clinical data: are a collection of observations about a patient.

A datum: is a single observation of a patient, Each datum has five elements:

- the patient (Amr Jamal)
- the attribute (parameter) (heart rate) these are values collected from the patient
- the value of the attribute (52 beats per minute) without the value/unit these data will be meaningless!
- the time of the observation (1:00 pm on 1/1/2015) some attributes need specific time for the sake of any change and accuracy
- the method by which the attribute was obtained (heart monitor)

Types of clinical data

Narrative	Numerical measurements	Coded data	Textual data	Recorded signals	Pictures
recording by clinician-maternity history	blood pressure, temperature	selection from a controlled terminology system example being the term MI that may mean myocardial infarction or mitral insufficiency	other results reported as text	EKG, EEG	radiographs, photographs, and other images

Why is it important to know the type of the data?

- 1-To know how you will retrieve them
- 2-How to store them
- 3- And how to analyze them

-Each type has its own entry (this term will be explained later) so this allows capturing different data

-**Narrative data:** it has a lot of context. It can be both alphabetical and numerical data. **Subjectivity** is high!!

-**Numerical measures:** All are collected in numbers and contain unique measures and units for comprehension of data

-**Coded data:** Depends on terminology, example; **ICT10**

-**Textual data:** Results are in text (includes narrative)

-**Recorded data:** stored in file and contains descriptions of these data

-**Pictures:** commonly used in Radiology.

Use of clinical data

- ❖ Form basis of historical record
- ❖ Support communication among providers Example of that is getting feedback
- ❖ Anticipate future health problems Through narrative data (history of the patient)
- ❖ Record standard preventive measures such as alcohol screening which is based on guidelines
- ❖ Identify deviations from expected trends example being a growth chart
- ❖ Coding and billing The doctor will make the diagnosis and that will require treatment and also the diagnostic tests which were used all of which costs money! So the organization has to keep track of what being paid
- ❖ Provide a legal record doctors can't remember everything and when there is a medicolegal issue, physician could be called to the court to tell details and hence data can be used there
- ❖ Support clinical research



clinical data

Types of Clinical Data Documents

History and physical examination	Progress notes	Reports	Typical paper chart maintains all patient notes in chronological order, sometimes separated into different components
1-by a clinician	1-update of progress by primary, consulting, and ancillary providers Reports	1-by specialists, ancillary providers	

Complications of data

★ **Circumstances of observation**
 e.g., how was heart rate taken? pulse? EKG?

For example, was the blood pressure taken in the arm or leg? Was the patient lying or standing? Was the pressure obtained just after exercise? During sleep? What kind of recording device was used? Was the observer reliable?

★ **Uncertainty**
 how accurate is patient reporting, measurement, device?
 One technique is to collect additional data that will either confirm or eliminate the concern raised by the initial observation but this solution is not always appropriate,

★ **Time**
 what level of specificity do we need?
 (minute-to-minute variations may be important—e.g., the frequent blood sugar readings obtained for a patient in diabetic ketoacidosis)

-Data quality must be good and there is many things can affect its quality (Complications)
 -Time is crucial and a one had to be specific when documenting timing of data, for that it can determine the quality!!
 -Uncertainty is most obvious with narrative type data
 -In duplication of data we face a problem which is not knowing which data is more accurate
 -Outdated data can not be retrieved

★ **Duplication**
 e.g., multiple records in different departments

★ **Outdated**
 missing values

★ **Incorrectly formatted**
 does not follow standards

Structure of clinical data

- ❖ Medicine lacks uniform structured vocabulary and nomenclature as does Physics and Chemistry MD graduates from different universities uses different terms due to different schools of medicine
- ❖ Standardization and computerization of data is benefited by standard representations (Cimino, 2007)
- ❖ Counter-arguments are “freedom of expression” and “art of medicine” structured data limit freedom of expression and this means no art in medicine
- ❖ Narrative information when expressed in many ways can be ambiguous Each doctor has its own way of narrating “variable narrative data”

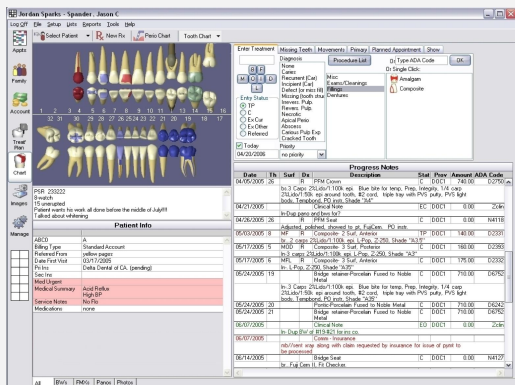


Data entry

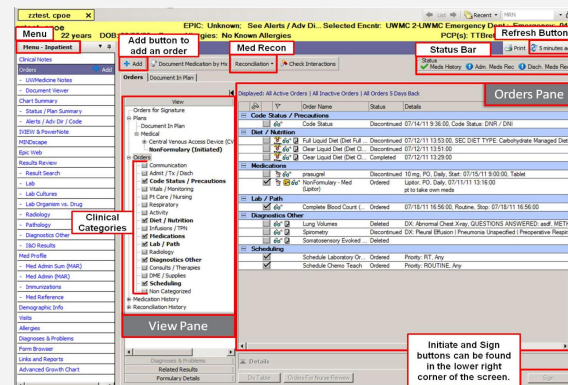
General categories of data entry:

- ❖ **Free-form** entry by historical methods:
 - 1-writing
 - 2-dictation
 - 3-typing
- ❖ **Structured (menu-driven) data** entry by mouse or pen
- ❖ **Speech recognition** for either of above

-Data entry has different forms; **Free form** is used with **unstructured data**. In structured data you enter the data by **choosing from menu** using either a pen (or we call it the Stylish) or by mouse
 -An example of data entry medium is the **Customized tablet by philips (imp)!! (using interface for Electronic health record)**
 -Speech recognition is used for **entering both** structured and non structured data



In this example of data entry system (it is a dental electronic record), we have **three types** of data: 1-Coded 2-Numerical 3-Textual



Here, all data are **coded** which means it is already defined and all you have to do is to choose from the menu (**tick box**) which order you need without typing them

Types of speech recognition system

- 1)**Speaker dependent system:** It's developed to operate for a single speaker. It's easy to develop, cheap to buy & more accurate. It works by learning the unique characteristics of a single person's voice, similar to voice recognition.
- 2)**Speaker independent system:** It's developed to operate for any speaker of a particular type (e.g. American English). It designed to recognize anyone's voice, so no training involved.
- 3)**Speaker adaptive:** Usually begins with a speaker independent model & adjust these models more closely to each individual during a brief training period.

Structured or menu-driven data entry

- Can be done via mouse or pen, with typing
- Benefits: (Reduces errors)
 - 1-Data codified for easier retrieval and analysis computer helps
 - 2-Reduces ambiguity if language used consistently
- Drawbacks (Depends on codes mainly)
 - 1-In general, more time-consuming
 - 2-Requires exhaustive vocabulary refers to all codes which requires memorizing
 - 3-Requires dedication to use by clinicians it is important to enter right code to avoid mistakes

Speech recognition for data entry

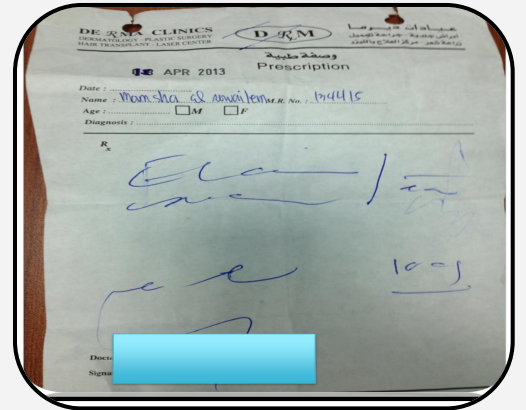
- Most common use is for narration (converts voice into text) e.g., computer dictation of clinical notes
- An advantage is instant availability of dictated content
- Continuous speech recognition now is commercial reality:
 1. Speaker-dependent systems require user training it gets familiar with your accent and way of pronouncing words
 2. Speaker-independent are systems less accurate doesn't need training

Coded vs. free-text data

Coded data	Free text
Documentation of discrete data from controlled vocabulary.	Alphanumeric data that are unstructured, typically in narrative form.

Issues with coded data

- ◆ “Pick from a list” allows wrong selection
- ◆ Compliance concerns
- ◆ Over documentation for care because everything has to be coded, multiple codes
- ◆ Cloning system allows copy and paste



It is hard tell from this handwriting whether this data is narrative or recorded!!

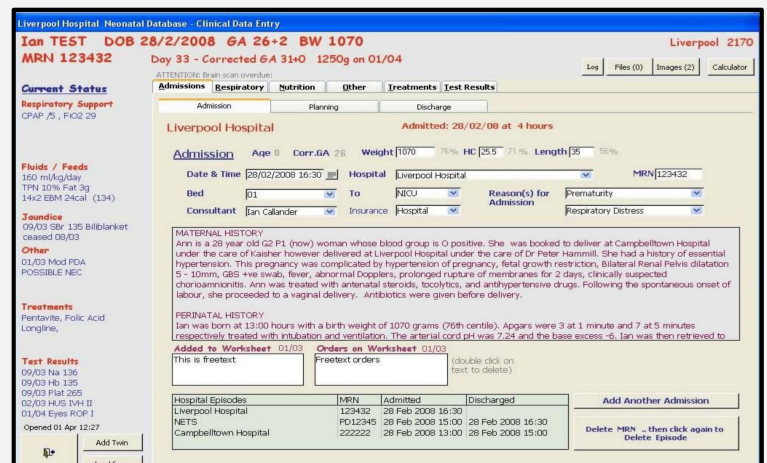
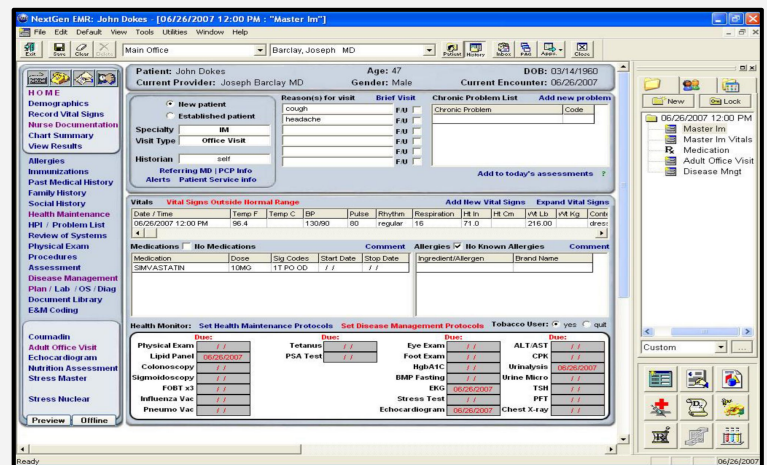
Narratives tell a story

A narrative tells a story:

- ❖ See the patient through a description
- ❖ Complicated events are easier to describe in text rather than filling them in codes

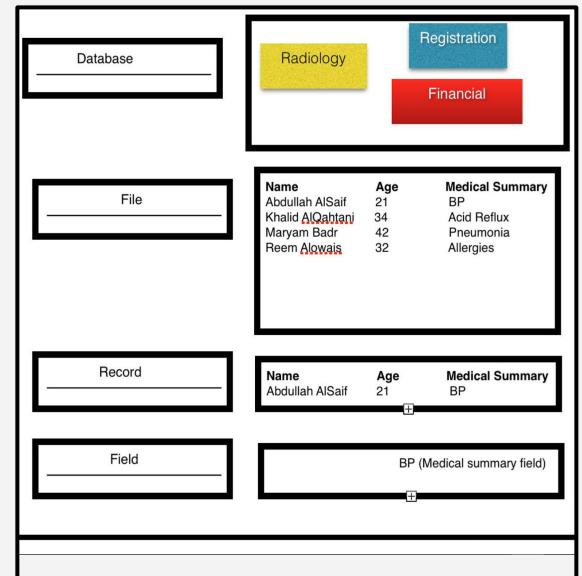
Undifferentiated problems:

- ❖ Interpretation. Open for subjectivity; variation among doctors “only a human can prioritize and determine what the chief complaint really is”



Data Management

File Organization concepts	
Database:	A set of related files
File:	Collection of records of same type
Record:	A set of related field
Field: or attribute	Words and numbers



Data management:

- 1-The field which is the simplest one (or we can call it the attribute) , it is a single attribute
- 2-Record is the collections of attributes of the same patient >> One patient with multiple fields

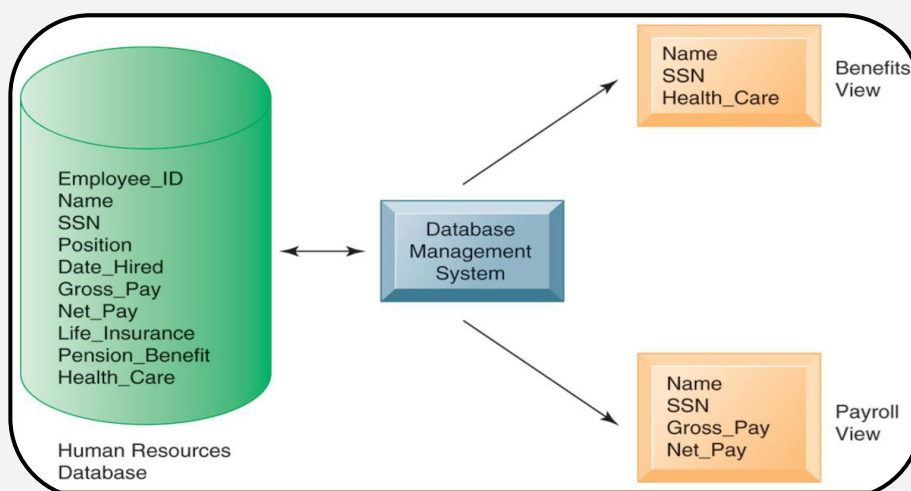
- 3-File is different patient with their own records
- 4-Database is to connect all files to different departments

Relational DBMS

- ❖ Relational model links records to tables
- ❖ Allows efficiencies
 - One-time information (e.g., demographics) stored only once because all connected files are accessible
 - Complex queries easier to construct and carry out because you are specific about the data and each has its own definition
- ❖ Most query capabilities are based on Structured Query Language (**SQL**)
 - **special language in relational database**

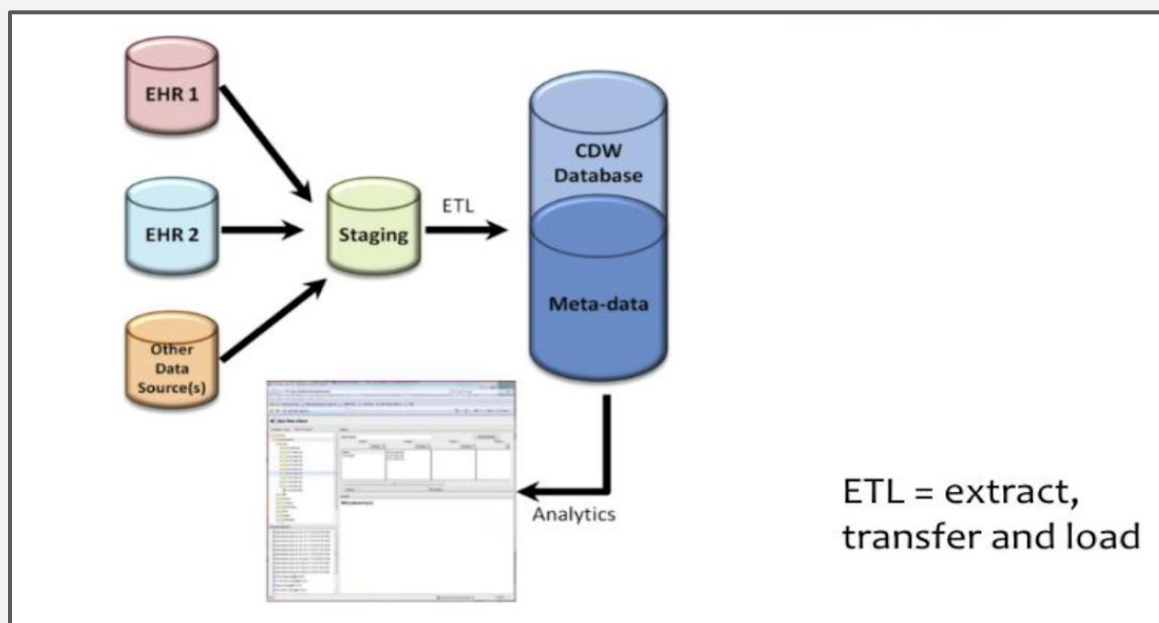
What is view in DBMS (Database Management System)?

A *view* is a subset of the database, which is defined and dedicated for particular users of the system. Multiple users in the system might have different views of the system.



Clinical Data Warehouse

- » Data from EHRs, Radiology, Pathology, etc. are copied into a staging database where they are cleaned and loaded into another common database and associated with metadata (data that describes other data). ICD-type data is an example of metadata. ICD 10 is for diagnosis
- » Tools can be applied to the data in the CDW (Clinical Data Warehouse), such as simple descriptive analytics that reports the number of patients with breast cancer, their age, menopausal status, etc. Everything is connected to each other and you can use a uniidentifier to find information about one patient
- » CDWs do a better job of analyzing and reporting aggregate healthcare data than the average EHR (Electronic health record), which tends to focus on the individual. It has to be powerful to help in analysis
- » CDWs can be used to evaluate a critical clinical process, cost estimates and they can analyze potential solutions. Because you have an access to all patient data so you have an idea about everything has been done and spent
- » CDWs are highly valuable for informatics and evidence based medical research. The use of artificial intelligence to analyze data and make decisions for healthcare providers
- » CDWs can help track infections and report trends to public health. It is more powerful database (the CDW)



This diagram shows how **health ministry** stores databases from different hospitals: Data from different hospitals will have to go first to Staging then it will be extracted, transferred and loaded into the CDW which later may go to metadata for analysis



Book Summary

What Are Clinical Data?

- Data provide the basis for categorizing the problems a patient may be having or for identifying subgroups within a population of patients. They also help a physician to decide what additional information is needed and what actions should be taken to gain a greater understanding of a patient's problem or most effectively to treat the problem that has been diagnosed.
- Clinicians need to share descriptive information with others. When they cannot interact directly with one another, they often turn to the chart or electronic health record for communication purposes.
- We consider a clinical datum to be any single observation of a patient, it is a matter of perspective whether a single observation is in fact more than one datum. For example, if the difference between diastolic and systolic blood pressures is important for decision making or for analysis, however, the blood pressure reading is best viewed as two pieces of information (systolic pressure = 120 mmHg, diastolic pressure = 80 mmHg). Rather than 120/80. If clinical datum is a single observation about a patient, clinical data multiple observations.

What Are the Types of Clinical Data?

- Narrative data account for a large component of the information that is gathered in the care of patients. For example, the patient's description of his or her present illness, including responses to focused questions from the physician, generally is gathered verbally and is recorded as text in the medical record.
- Many data used in medicine take on discrete numeric values, but it has to be interpreted correctly. For example: Is a 1-kg fluctuation in weight from 1 week to the next significant? Was the patient weighed on the same scale both times (i.e., could the different values reflect variation between measurement instruments rather than changes in the patient)?
- Note that there are significant problems associated with the use of such abbreviations. For example, "MI" can mean "mitral insufficiency" (leakage in one of the heart's valves) or "myocardial infarction" (the medical term for what is commonly called a heart attack).
- When such data are stored in medical records, a graphical tracing frequently is included, with a written interpretation of its meaning.
- Visual images, for example, a sketch is a concise way of conveying the location and size of a nodule in the prostate gland.

As should be clear from these examples, physicians and other health care personnel are taught from the outset that it is crucial that they do not trust their memory when caring for patients. They must record their observations, as well as the actions they have taken and the rationales for those actions, for later communication to themselves and other people.

Who Collects the Data?

Physicians are key players in the process of data collection and interpretation and many different individuals employed in health care settings gather, record, and make use of patient data in their work.





Book Summary

Uses of health data

- **Form basis of historical record**

We learn from the aggregation of information from large numbers of patients; thus, the historical record for individual patients is of inestimable importance to clinical research.

- **Support communication among providers**

The care given to a patient is focused on management of one or more chronic disorders—possibly over many years, so that they could refer to data about past illnesses and treatments as a guide to evaluating future care issues. Now the record

not only contains observations by a physician for reference on the next visit but also serves as a communication mechanism among physicians and other medical personnel,

- **Anticipate future health problems**

Educating patients about the ways in which their environment and lifestyles can contribute to, or reduce the risk of, future development of disease.

- **Record standard preventive measures**

counseling or educational programs (for example, regarding smoking cessation, the vaccinations that begin in early childhood and continue throughout life. Such data can prevent unnecessary treatments that may be associated with risk or significant cost.

- **Identify deviations from expected trends**

A pediatric growth chart. Single data points would not be useful; it is the changes in values over time that indicate whether development is progressing normally

- **Provide a legal record**

The medical record is the foundation for determining whether proper care was delivered. Thus, a well-maintained record is a source of protection for both patients and their physicians.

- **Support clinical research**

through the aggregation and statistical or other analysis of observations gathered from populations of patients

A randomized clinical trial (RCT) is a common method

The Structure of Clinical Data

Medicine is remarkable for its failure to develop a widely accepted standardized vocabulary and nomenclature. For example, one physician might note that a patient has “shortness of breath.” Later, another physician might note that she has “dyspnea.” Unless these terms are designated as synonyms, an automated program will fail to indicate that the patient had the same problem on both occasions.

Note: Both high-quality care and scientific progress depend on some standardization in terminology.

Coding Systems

For example, cases of gonorrhea, syphilis, and tuberculosis generally must be reported to local public-health organizations, which code the data to allow trend analyses over time. The World Health Organization publishes a diagnostic coding scheme called the International Classification of Disease (ICD).

In a particular clinical setting, none of the common coding schemes is likely to be completely satisfactory. In some cases, the granularity of the code will be too coarse; on the one hand, a hematologist (person who studies blood diseases) may want to distinguish among a variety of hemoglobinopathies (disorders of the structure and function of hemoglobin) lumped under a single code in ICD8-CM. On the other hand, another practitioner may prefer to aggregate many individual codes—e.g., those for active tuberculosis—into a single category to simplify the coding and retrieval of data.



Questions

1. which of the followings is picture data?

- A. Temperature.
- B. Blood test.
- C. X-ray.
- D. EMG.

2. Which of the following is a major limitation in using abbreviation in narrative data?

- A. Produce ambiguity.
- B. Hard to read.
- C. Needs skills.
- D. Against patient's privacy.

3. "Pick from a list" allows wrong selection, compliance concerns, cloning and limitations are issues for?

- A. Coded data.
- B. Voice recognition.
- C. Language processing.
- D. Manual data entry.

4. The veracity of big data is due to which of the following?

- A. Uncertainty of data
- B. Velocity of data
- C. Multiple sources of data
- D. Different forms of data

5. What of these describe narrative?

- A. Business Documents.
- B. Choose from a list.
- C. Report as text.

6. "140/90 mmhg" is considered which one of data elements?

- A. attribute
- B. value of the attribute
- C. time of the observation
- D. method obtained

7. "Collection of records" is definition of what?

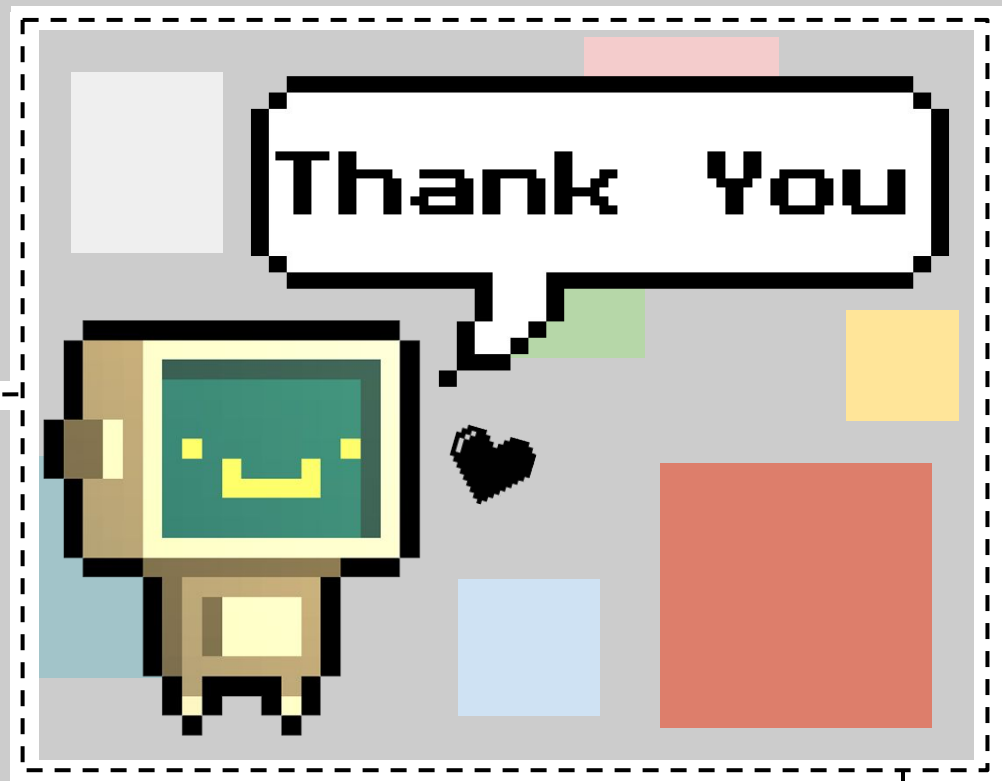
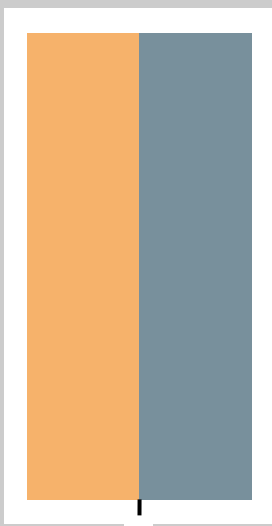
- A. Field
- B. File
- C. Database
- D. Record

8. The type of data that makes the data (understandable) for the computer:

- A. Coded data
- B. Free form data
- C. Unstructured data
- D. Dictated data



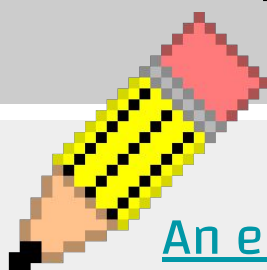
1.C,
2.A,
3.A,
4.A,
5.C,
6.B,
7.B,
8.A



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