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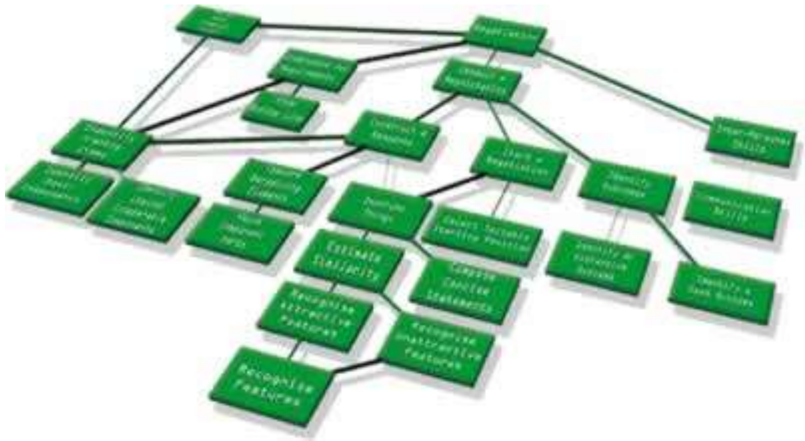

Knowledge Engineering

Workbook for E-portfolio (V. 3)

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Content

Introduction

This course introduces students to the practical application of intelligent technologies into the different subject domains (business, social, economical, educational, human, etc.). It will give students insight and experience in key issues of data and knowledge processing in companies. In class and discussion sections, students will be able to discuss issues and tradeoffs in visual knowledge modeling, and invent and evaluate different alternative methods and solutions to better knowledge representation and understanding, sharing and transfer. It is targeted at managers of different level, involved in any kind of knowledge work. Lecture course' goals are focused at using the results of multidisciplinary research in knowledge engineering, data structuring and cognitive sciences into information processing and modern management. The hand-on practice will be targeted at e-doodling with Mind Manager and Cmap software tools.

The class features lectures, discussions, short tests and, students will have 20 hand-on practices (or assignments) using mind-mapping and concept mapping software. Lectures will be important but the emphasis will be on learning through training, games, discussions and short tests. A good deal of the course focus on auto-reflection and auto-formalizing of knowledge, training of analytical and communicative abilities, discovery, creativity, achieving new perspectives, synthesizing evidence from disparate sources, and gaining new insights in this fascinating new field.

Knowledge engineering is the discipline of mapping intellectual assets. By this workbook students will be shortly introduced to major practical issues of the course on knowledge engineering. The focus of the course is on the visualizing of data and knowledge.

Students will gain an understanding in the practical skill of visual business information structuring with the use of special software (mind mapping and concept mapping) while doing the assignments.

The assignments will examine a number of related topics, such as:

- system analysis and its applications;
- the relationship among, and roles of, data, information, and knowledge in different applications including marketing and management, and the varying approaches needed to ensure their effective implementation and deployment;
- characteristics of theoretical and methodological topics of knowledge acquisition, including the principles, visual methods, issues, and programs;
- defining and identifying of cognitive aspects for knowledge modelling and visual representation (mind mapping and concept mapping techniques).

Grading Policy: Final exam – 50%, 20 % - fulfilment of obligatory assignments (E-portfolio), 5% - class activity, 5% -paper, 5% -presentation, 5% - rating tests, 10 % -midterm examination test.

Chapter 1

Methodical recommendations and examples for assignment list 1

1.1. Intensional/extensional

A rather large and especially useful portion of our active vocabularies is taken up by general terms, words or phrases that stand for whole groups of individual things sharing a common attribute. But there are two distinct ways of thinking about the meaning of any such term.

The **extensional** of a general term is just the collection of individual things to which it is correctly applied. Thus, the extension of the word "chair" includes every chair that is (or ever has been or ever will be) in the world. The **intension** of a general term, on the other hand, is the set of features which are shared by everything to which it applies. Thus, the intensional of the word "chair" is (something like) "a piece of furniture designed to be sat upon by one person at a time."

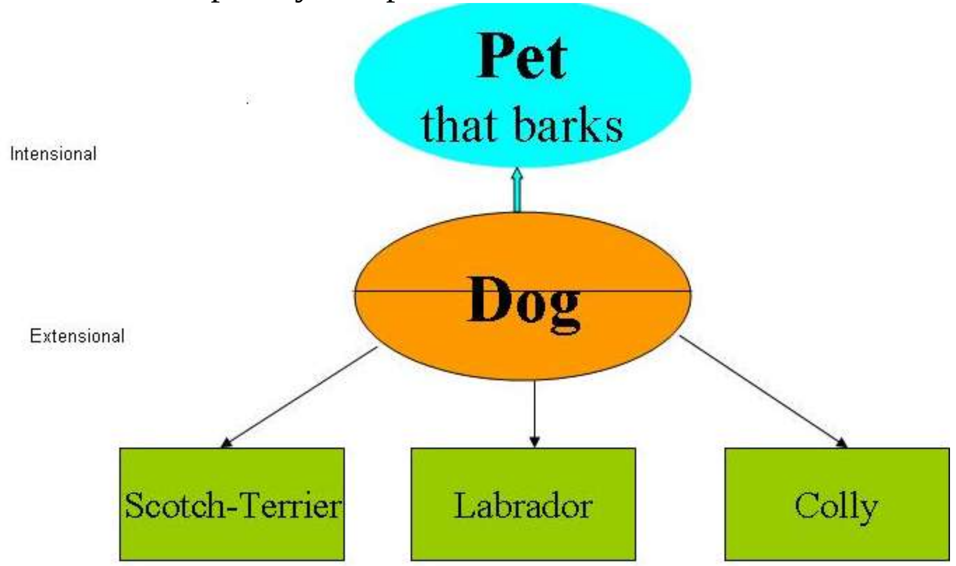


Fig. 1. Intensional and extensional definition of term “Dog” (MS Word)

1.2. Mind maps

Mind map is a diagram used to represent words, ideas, tasks, or other items linked to and arranged radially around a central key word or idea. Mind maps are used to generate, visualize, structure, and classify ideas, and as an aid in study, organization, problem solving, decision making, and writing.

The elements of a given mind map are arranged intuitively according to the importance of the concepts, and are classified into groupings, branches, or areas, with the goal of representing semantic or other connections between portions of information. Mind maps may also aid recall of existing memories. By presenting ideas in a radial, graphical, non-linear manner, mind maps encourage a brainstorming approach to planning and organizational tasks.

These are the brain-reflecting foundation structures of a Mind Map®. The more of them you follow, the more effective is your mind map.

- Start in the centre with an image of the topic, using at least 3 colours.
- Use images, symbols, codes and dimensions throughout your mind map.
- Select key words and print using upper or lower case letters.
- Each word word/image must be alone and sitting on its own line.
- The lines must be connected, starting from the central image. The central lines are thicker, organic and flowing, becoming thinner as they radiate out from the centre.
- Make the lines the same length as the word/image.
- Use colours - your own code - throughout the mind map.
- Develop your own personal style of mind mapping. Use emphasis and show associations in your mind map
- Keep the mind map clear by using Radiant hierarchy, numerical order or outlines to embrace your branches

Preparation for drawing Mindmaps (FreeMind)

1. Watch and listen to following video podcasts:
   Tony Buzan. About Mind mapping.
   http://www.youtube.com/watch?v=MlabrWv25qQ&feature=related
   How to make a mind map Version 1
   http://www.youtube.com/watch?v=v8_H42Z9wxA&feature=related
   How to make a mind map Version 2
   http://www.youtube.com/watch?v=0UCXalYcoko&feature=related
2. Look through mind map examples on the web
   http://mappio.com/
3. Start FreeMind software. Look through Documentation in the part named “Demonstration of some features”.
4. Create the following mind map (Fig.2) just for practice.

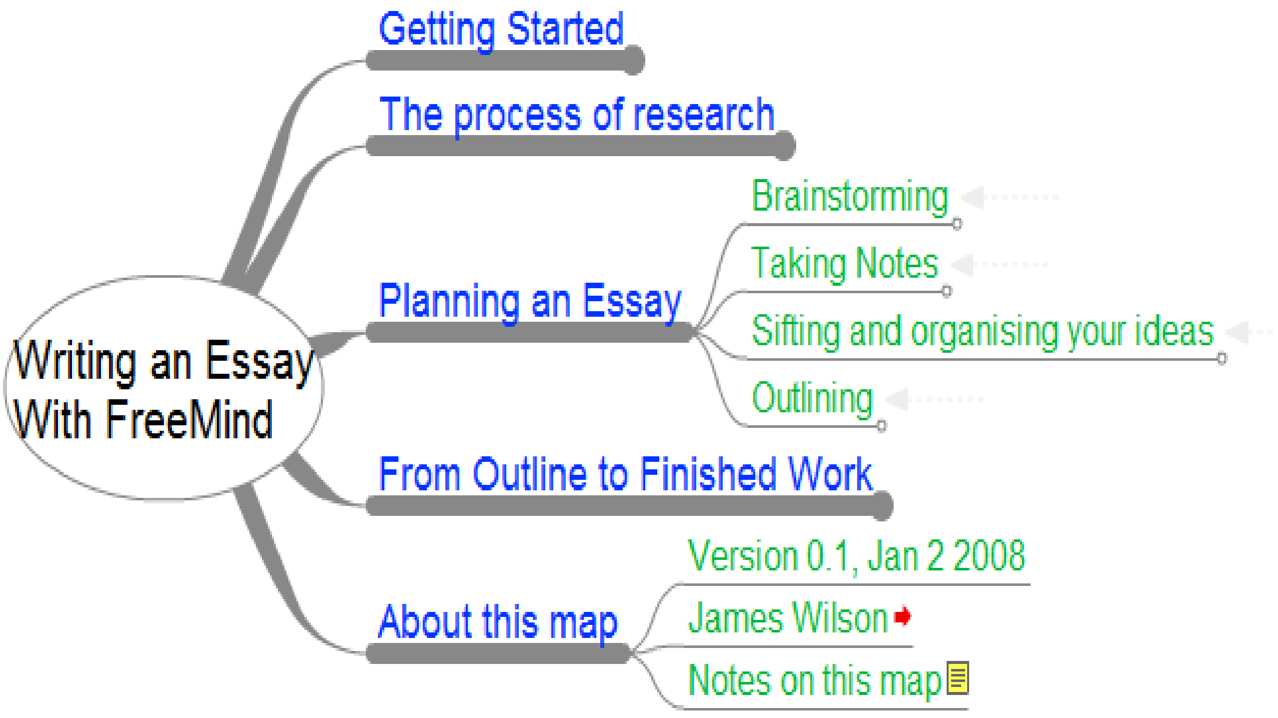


Fig.2. Example of a Mind map (by Free Mind)

1.3. Concept maps

Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts (Novak, 1998). Words on the line referred to as linking words or linking phrases, specify the relationship between the two concepts. The label for most concepts is a word, normally nouns.

Propositions are statements about some object or event in the universe, either naturally occurring or constructed. Propositions contain two or more concepts connected using linking words or phrases to form a meaningful statement. Sometimes these are called semantic units, or units of meaning. Figure 3 shows an example of a concept map.

Another characteristic of concept maps is that the concepts are represented in a hierarchical fashion with the most inclusive, most general concepts at the top of the map and the more specific, less general concepts arranged hierarchically below. The hierarchical structure for a particular domain of knowledge also depends on the context in which that knowledge is being applied or considered.

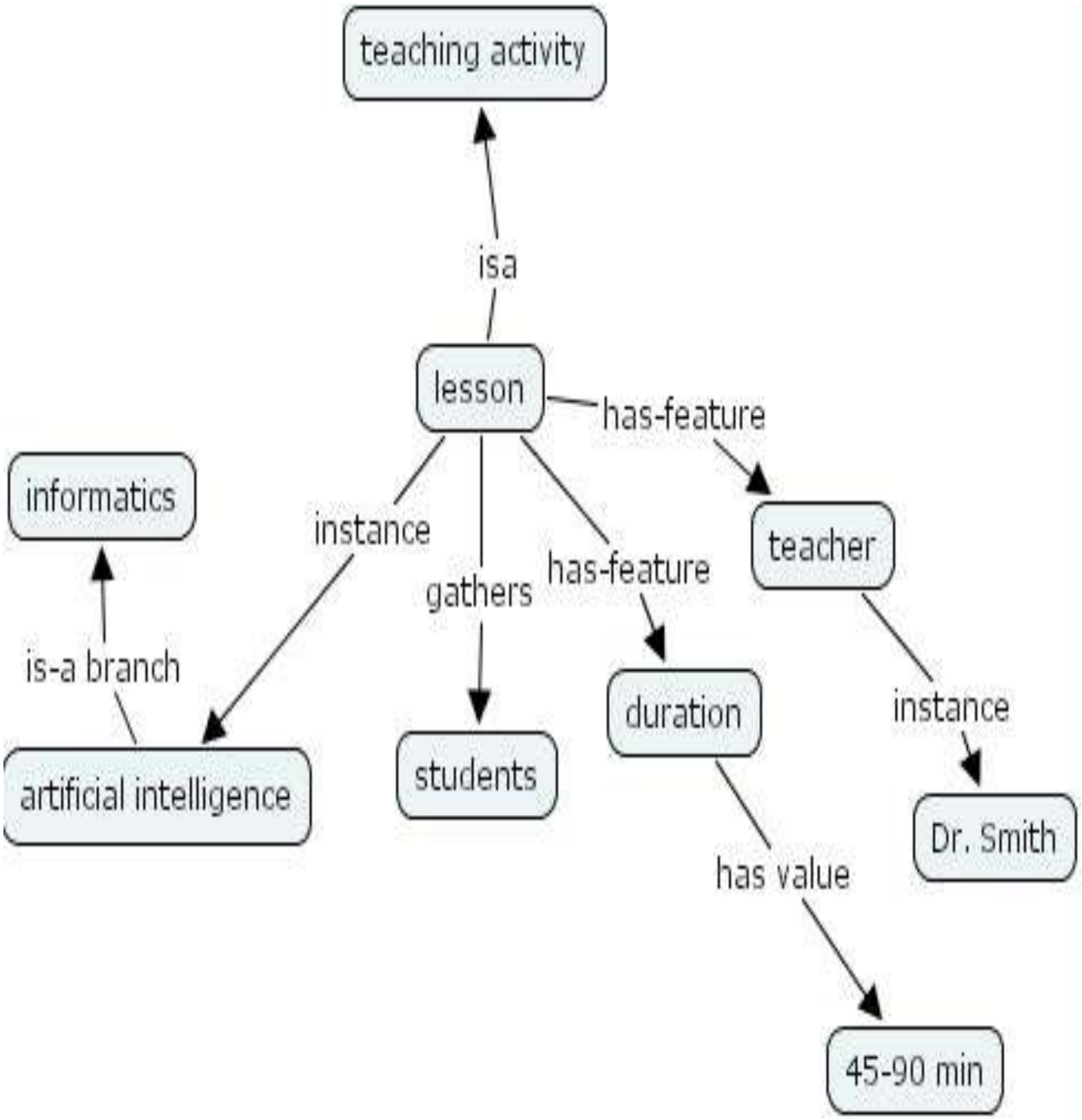


Fig.3. a Example of a concept map (Cmap tool)

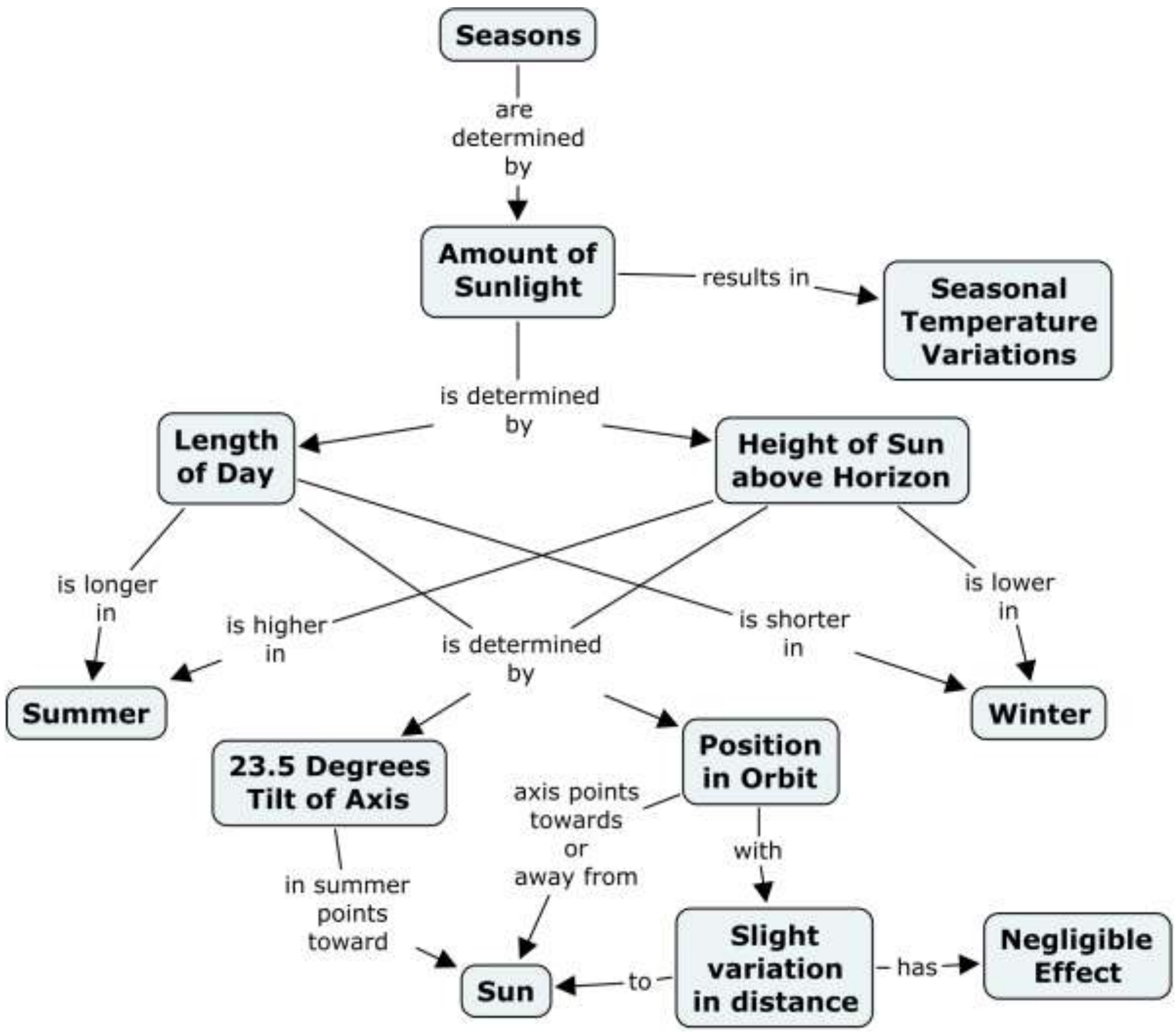


Fig.3. b Example of a concept map (Cmap tool)

1.4. Decision tables

A decision table is a tabular form that presents a set of conditions and their corresponding actions. For corporate management they are called as "business rules". The structuring algorithm looks like:

$$\{X\} \xrightarrow{\{R\}} \{Y\}$$

- Define goals or outputs or decisions {Y} (Fig.4 a)
- Create the glossary of input factors or facts (conceptual structure) {X} (Fig 4 b)
- Make up the ffunctional structure or rules{R} - decision table or reasoning model (Fig.4 c)

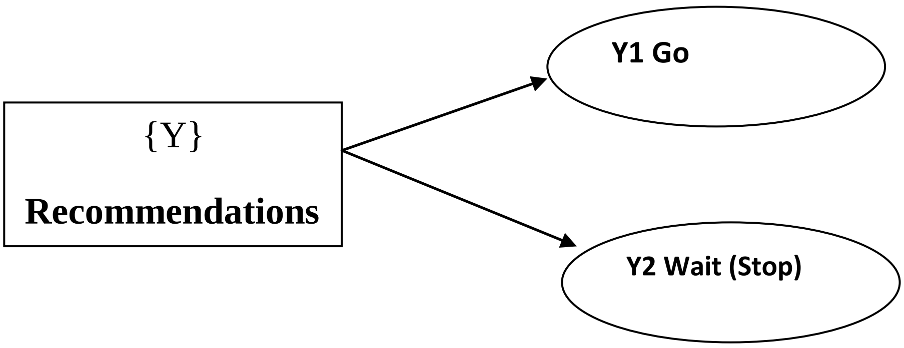


Fig.4 a. Example of recommendations (Y)

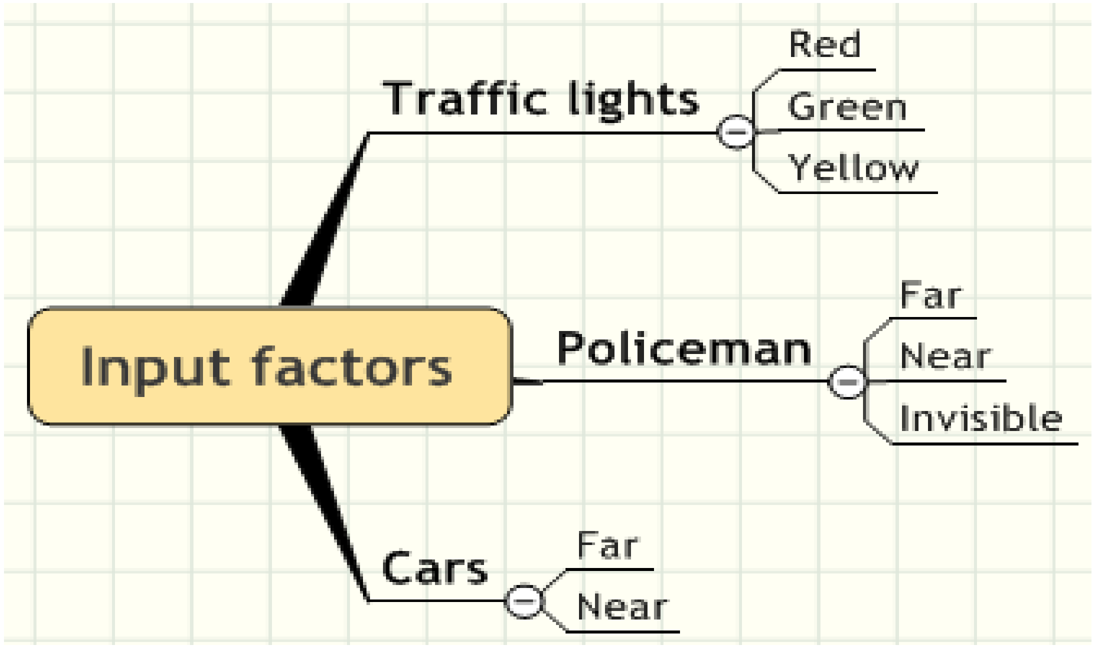


Fig.4 b. Example of a conceptual structure (X)

x1	*x2*	*x3*	*xn*	*y*	*p*
Color of traffic lights	**Police-man**	**Cars**	…	**Choice**	**Uncertainty**
Red or yellow				stop	0.9
Green				go	0.7
Yellow	far	far		go	0.8

Fig. 4 c. Example of a functional structure (R)

1.5. Decision Tree

A decision tree (or tree diagram) is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences (alternatives), including chance event outcomes, resource costs, and utility. Decision trees are commonly used in operations research, specifically in decision analysis, to help identify a strategy most likely to reach a goal (Wikipedia).

Decision Trees are useful tools for helping you to choose between several courses of action. They provide a highly effective structure within which you can explore options, and investigate the possible outcomes of choosing those options. They also help you to form a balanced picture of the risks and rewards associated with each possible course of action. This makes them particularly useful for choosing between different strategies, projects or investment opportunities, particularly when your resources are limited.

A set of logic statements about values of characteristics corresponds to decision trees. Each statement is obtained by passing the way from root to leaf. So, for example, for the tree represented on Fig. 5 a. the following list of statements corresponds to:

If X1 < 37 , Y="is health".

If X1 belongs to the interval [37,38.5] and X3="there is no reddening of throat", then Y="to catch cold";

If X1 belongs to the interval [37,38.5] and X3="there is reddening of throat", then Y="quinsy";

If X1 > 38.5 and X2="there is no cough", then Y="influenza";

If X1 > 38.5 and X2="there is cough", then Y="pneumonia";

Advantages and disadvantages of decision trees are shown at Fig.5 b. (source [http://www.bized.co.uk/educators/16-19/business/strategy/presentation/decision1_map.htm])

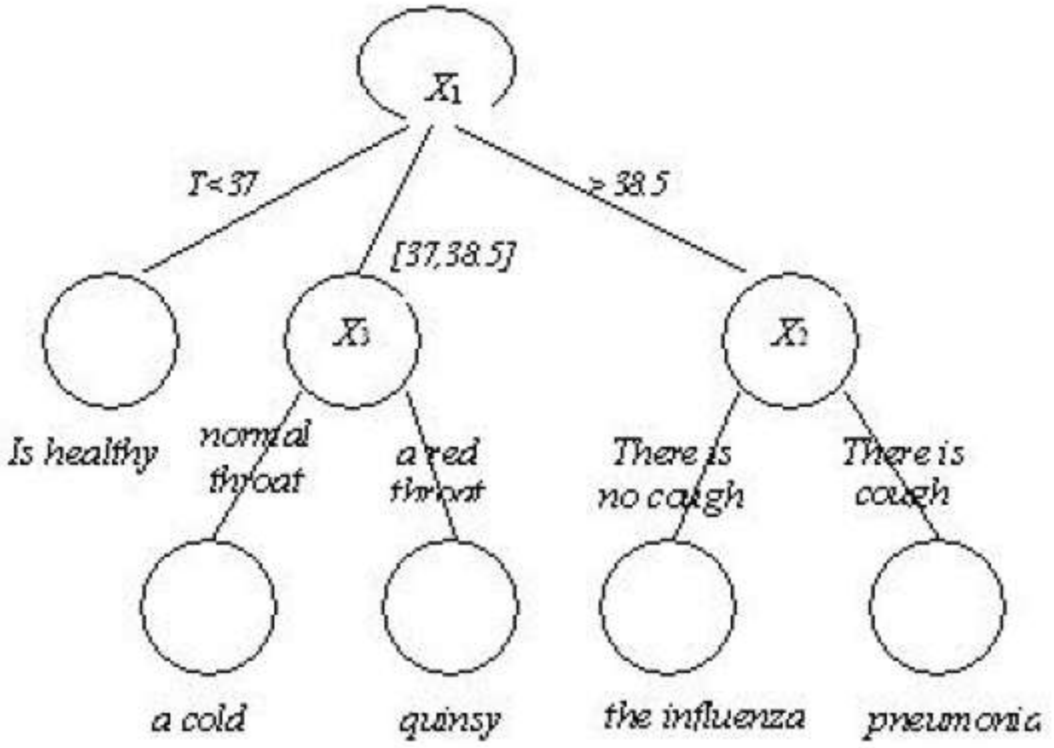


Fig.5.a. Decision tree example

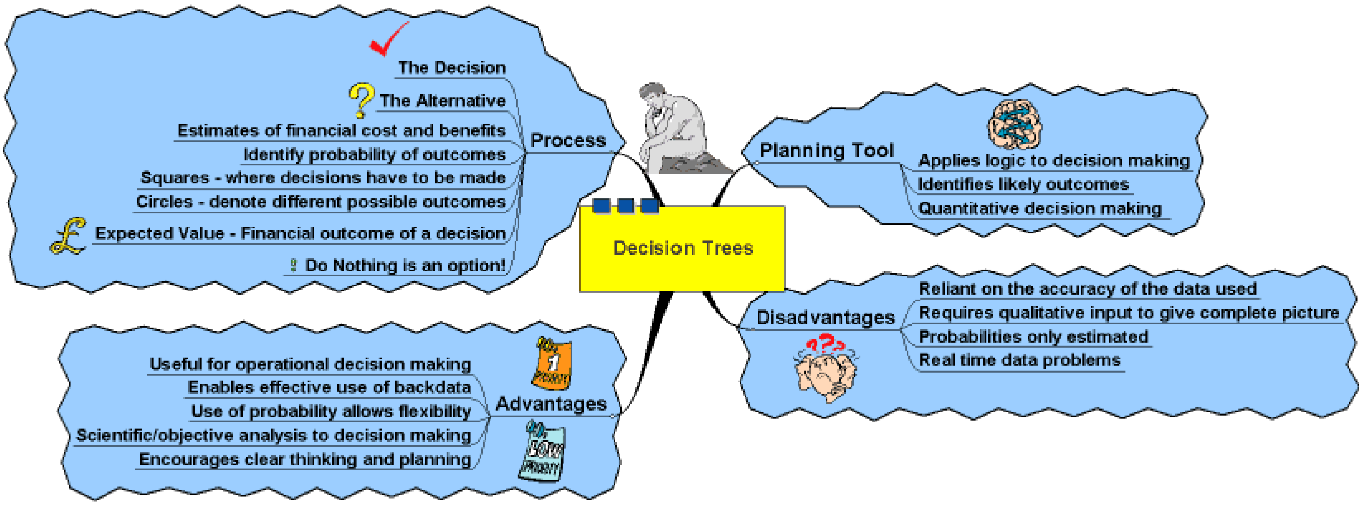


Fig.5 b. Decision tree summary

Another example of decision tree is presented at Fig. 5 c.

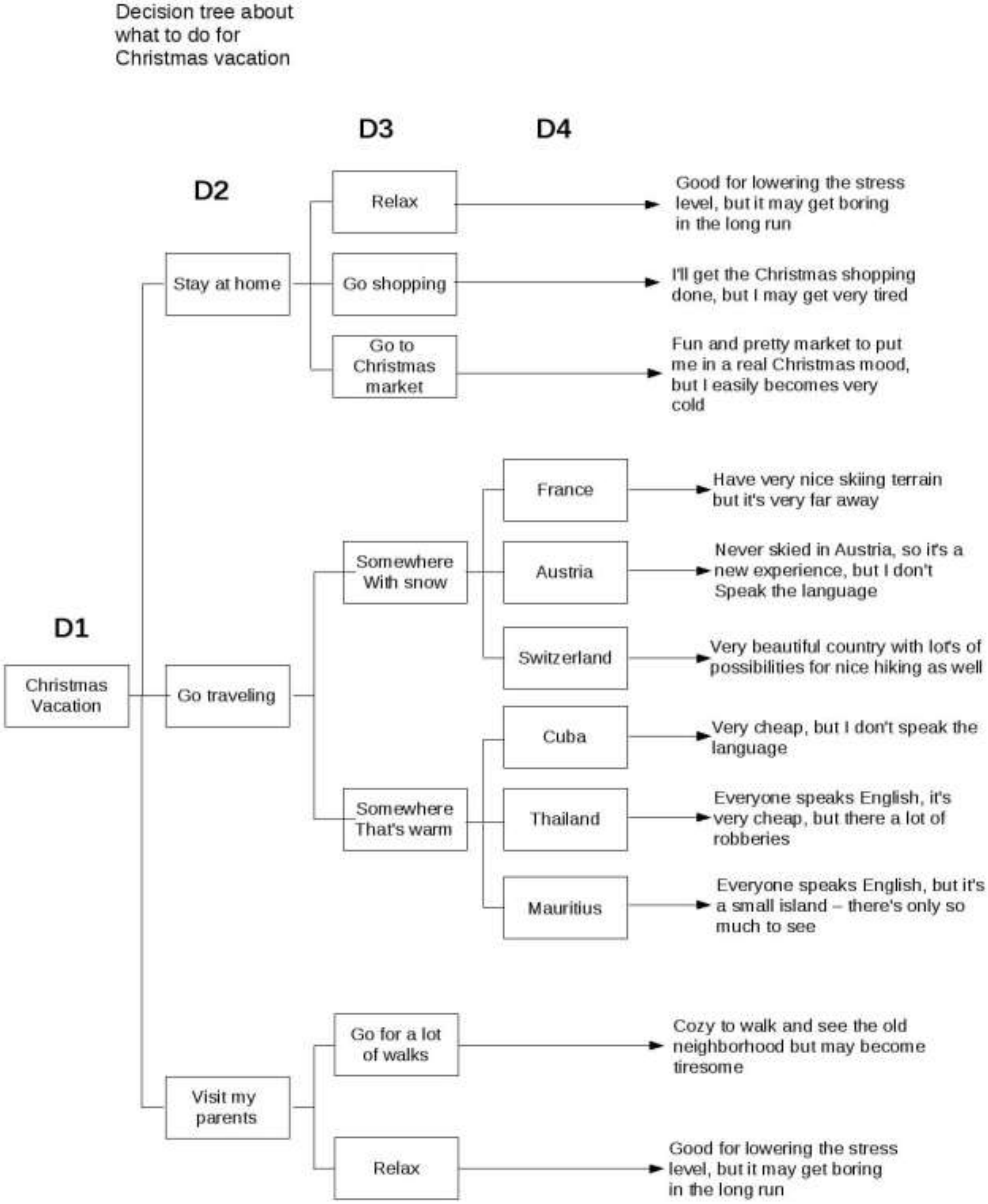


Fig.5 c. Another example of a decision tree

1.6. Cause-and-Effect Diagram

The purpose of a Cause and Effect diagram is to organize and graphically represent the causes of a particular problem (Fig.6). In a Cause and Effect diagram, also referred to as an Ishikawa diagram or Fishbone diagram, the problem is put at the "head" of the fish. The major fish bones are typically major drivers. From these major drivers, specific drivers that are causing the problem are listed. Besides the major drivers some sublevels and sub-sublevels can also be added as additional branches for each of these branches. An Effect can be represented by Problem, Objective, Goal. The major drivers are the categories of the factors that influence the effect being studied.

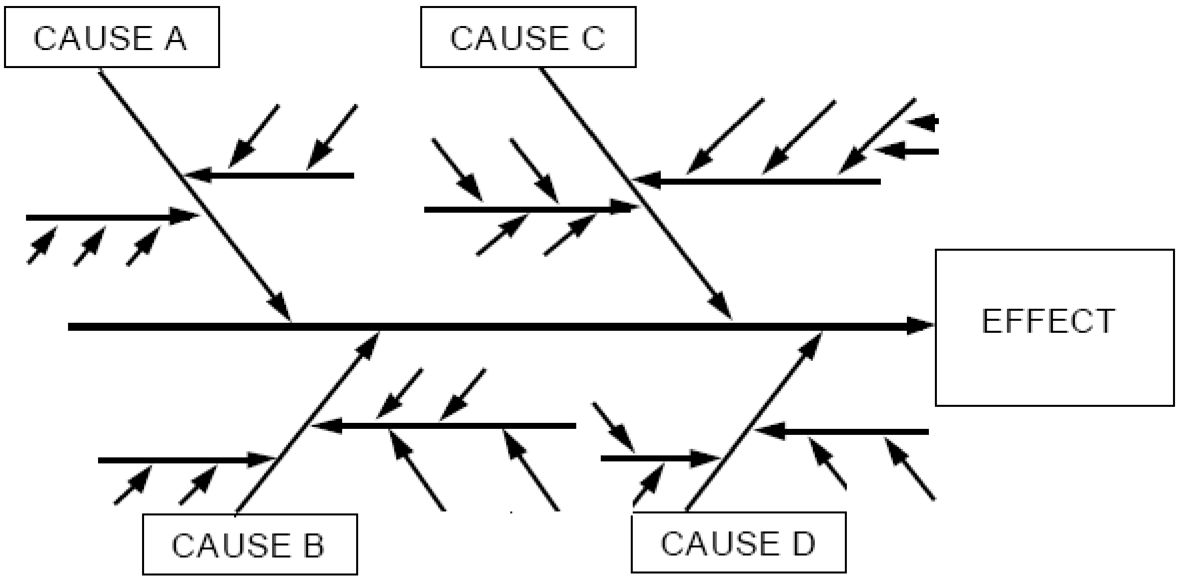


Fig.6 a. Example of cause-and-effect diagram

Benefits of Using a Cause-and-Effect Diagram
- Helps determine root causes
- Encourages group participation
- Uses an orderly, easy-to-read format
- Indicates possible causes of variation
- Increases process knowledge
- Identifies areas, where is the lack of data

To draw the cause and effect diagram in MS Visio you need to use Business Process type of diagram, and then specify the C&E type.

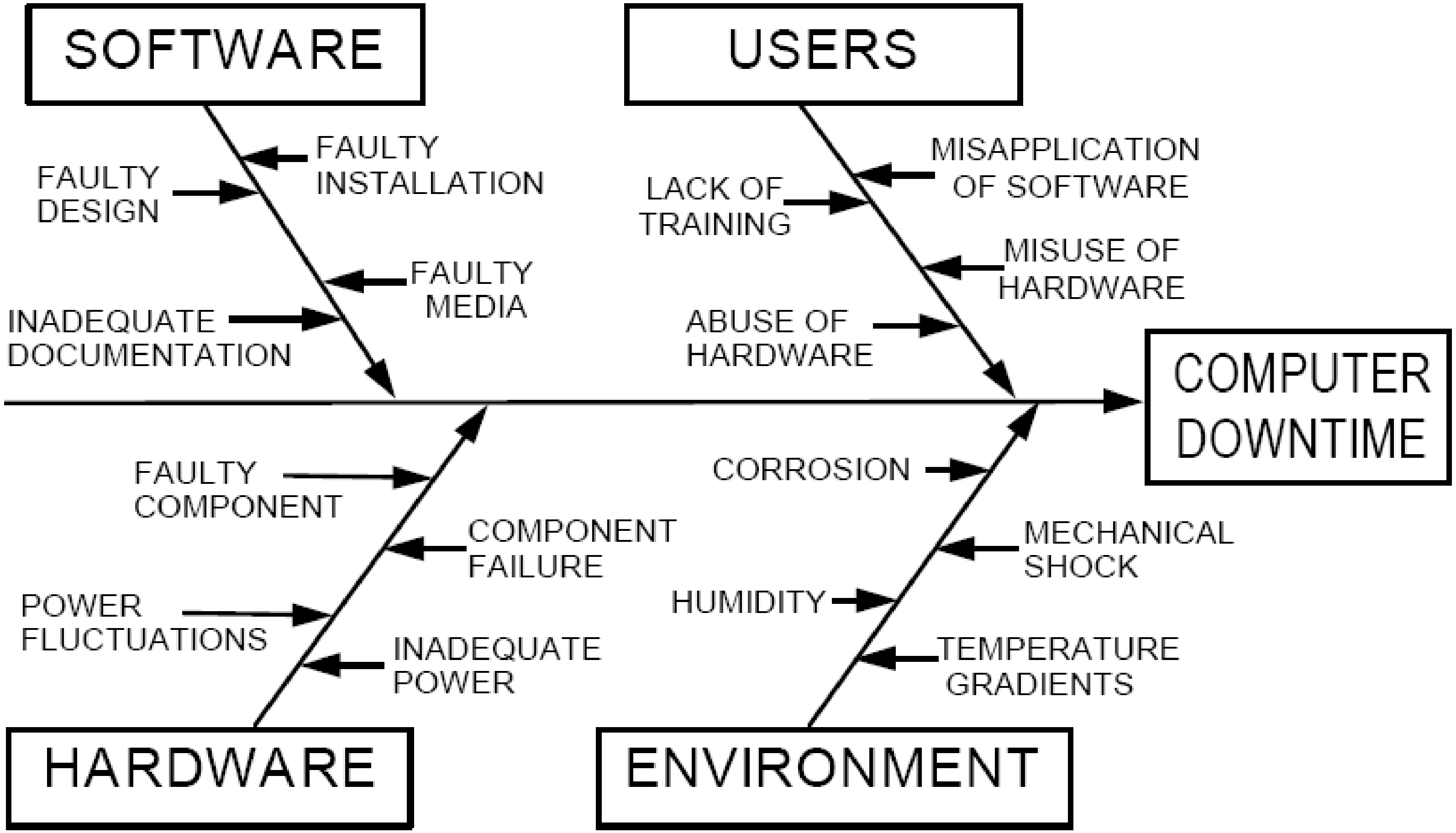


Fig. 6 b. Example of cause and effect diagram

Chapter 2

Methodical recommendations and examples for Assignment list 2

2.1. Frames

The concept of FRAMES was proposed by Marvin Minsky in 1972. Frames are used as an abstract structure for representation of stereotypes of complex objects, process, events, and scenarios. Cognitive psychologists have confirmed the fact that human brain uses frames to store knowledge. Frames could also be used to model rules and stereotypes in behaviour.

A frame consists of various (list of) attributes called slots. The main and obligatory slot is called AKO (A-kind-of).

Example of a frame “Cottage”

SLOT1. AKO: House

SLOT2. Quantity of floors: 1 to 3

SLOT3. Numbers of rooms: ≤6

SLOT4. Colour:

SLOT5. Price:

SLOT6. Address:

SLOT7. Purpose:

2.2. Flowcharts

Flowcharts are the ideal diagrams for visually representing business processes. For example, if you need to show the flow of a custom-order process through various departments within your organization, you can use a flowchart. This paper provides a visual representation of basic flowchart symbols and their proposed usage in communicating the structure of a well-developed web site, as well as their correlation in developing on-line instructional projects. A typical flowchart from older Computer Science textbooks may have the following kinds of symbols:

- **Start** and **end** symbols, represented as lozenges, ovals or rounded rectangles, usually containing the word "Start" or "End", or another phrase signaling the start or end of a process, such as "submit enquiry" or "receive product".
- **Arrows**, showing what's called "flow of control" in computer science. An arrow coming from one symbol and ending at another symbol represents that control passes to the symbol the arrow points to.
- **Processing steps**, represented as rectangles. Examples: "Add 1 to X"; "replace identified part"; "save changes" or similar.

- **Input/Output**, represented as a parallelogram. Examples: Get X from the user; display X.
- **Conditional** (or **decision**), represented as a diamond (rhombus). These typically contain a Yes/No question or True/False test. This symbol is unique in that it has two arrows coming out of it, usually from the bottom point and right point, one corresponding to Yes or True, and one corresponding to No or False. The arrows should always be labeled. More than two arrows can be used, but this is normally a clear indicator that a complex decision is being taken, in which case it may need to be broken-down further, or replaced with the "pre-defined process" symbol.
- A number of other symbols that have less universal currency, such as:
  - A **Document** represented as a rectangle with a wavy base;
  - A **Manual input** represented by rectangle, with the top irregularly sloping up from left to right. An example would be to signify data-entry from a form;
  - A **Manual operation** represented by a trapezoid with the longest parallel side upmost, to represent an operation or adjustment to process that can only be made manually.
  - A **Data File** represented by a cylinder

Flowcharts may contain other symbols, such as connectors, usually represented as circles, to represent converging paths in the flow chart. Circles will have more than one arrow coming into them but only one going out. Some flow charts may just have an arrow point to another arrow instead. These are useful to represent an iterative process (what in Computer Science is called a loop). A loop may, for example, consist of a connector where control first enters, processing steps, a conditional with one arrow exiting the loop, and one going back to the connector. Off-page connectors are often used to signify a connection to a (part of a) process held on another sheet or screen.

A flowchart is described as "cross-functional" when the page is divided into different "lanes" describing the control of different organizational chart units. A symbol appearing in a particular "lane" is within the control of that organizational unit. This technique allows the analyst to locate the responsibility for performing an action or making a decision correctly, allowing the relationship between different organizational units with responsibility over a single process.

Flowcharts use special shapes to represent different types of actions or steps in a process. Lines and arrows show the sequence of the steps, and the relationships among them.

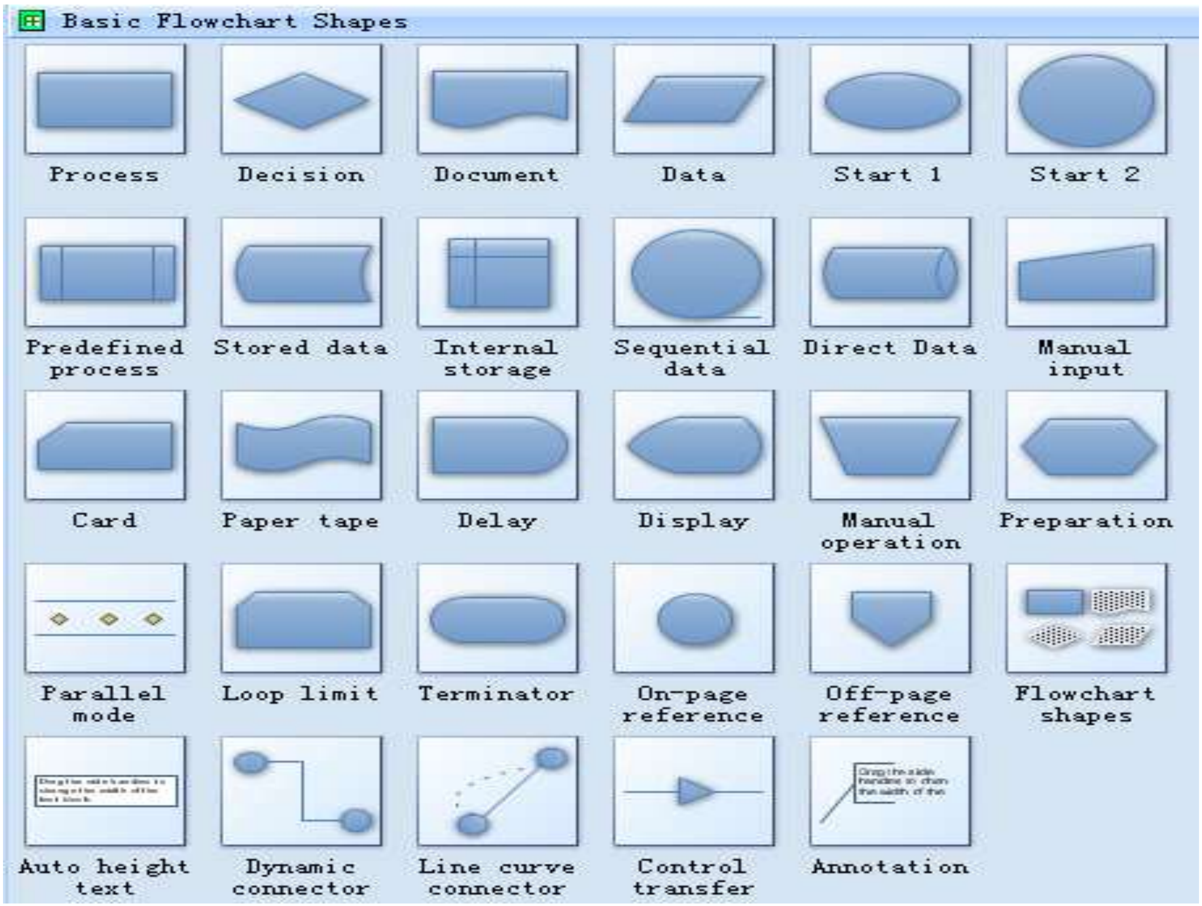


Fig.7. Standard Flowchart Symbols

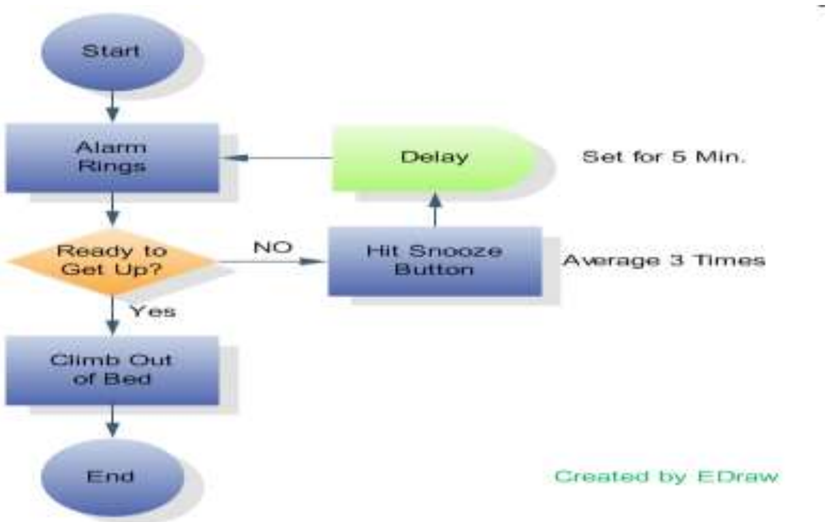


Fig.8. Example of a Flowchart (by Edraw)

2.3. Causal Chains

A causal chain is an ordered sequence of events which shows that one event in the chain causes the next.

The example of causal analysis framework to identify the causes of child malnutrition is represented on Fig. 9 a. Another example is presented on Fig.9 b.

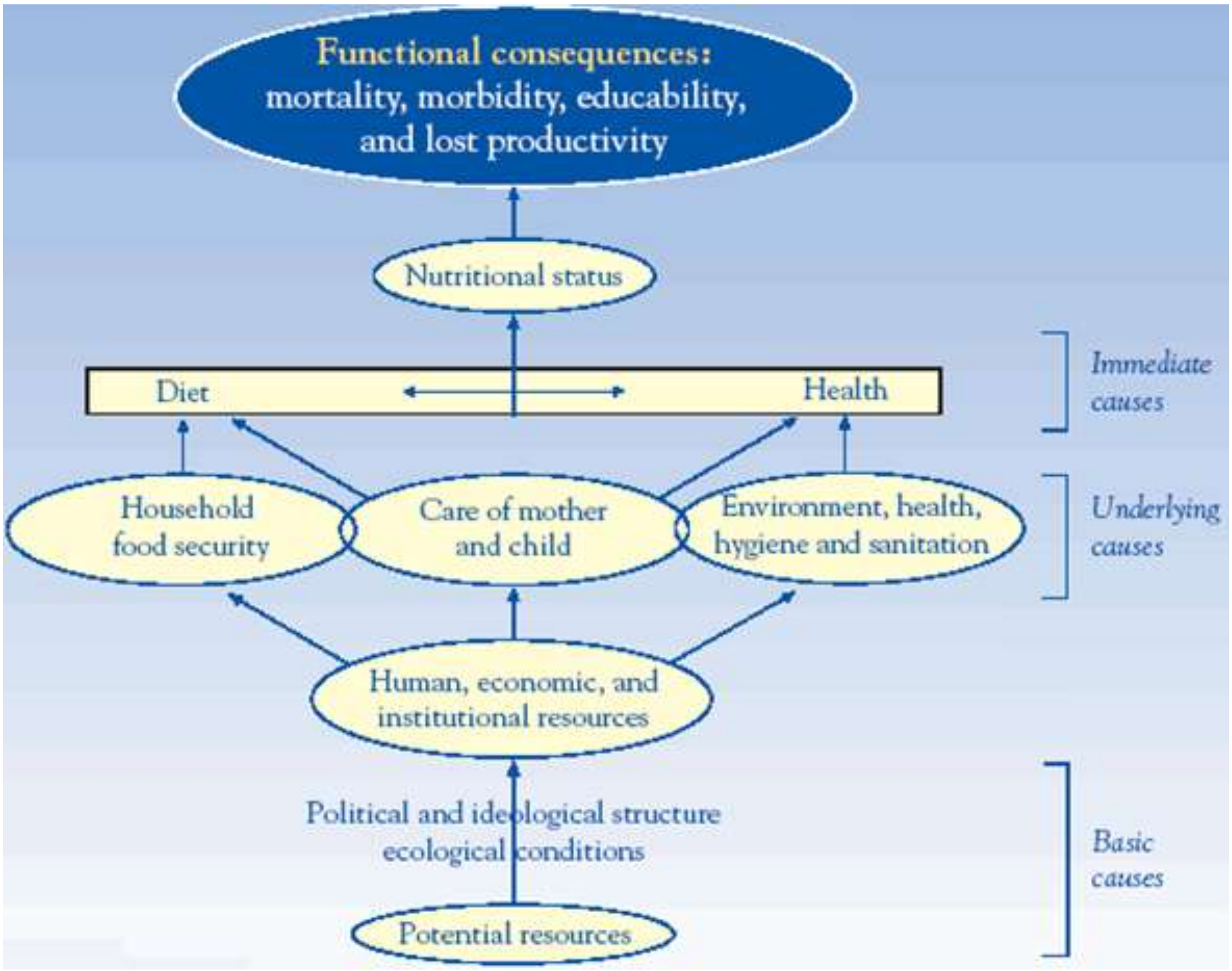


Figure 9 a. Causal chain describing possible reasons of child malnutrition.

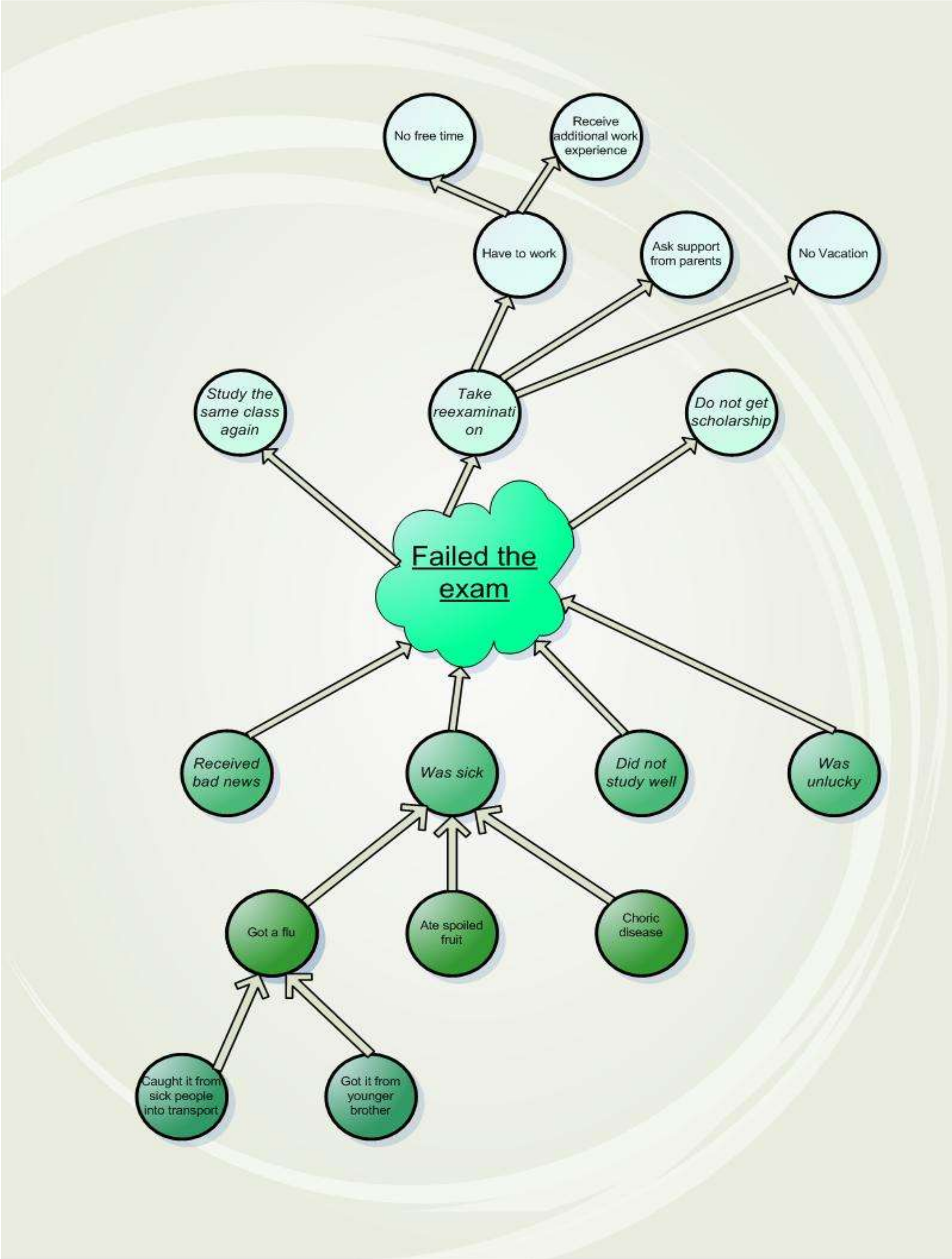


Fig. 9 b. Example of a causal chain (by Julia Boyko)

2.4. Fuzzy knowledge

Dr. Lotfi Zadeh in 1970 proposed a new branch of logic called fuzzy logic. It was targeted at processing quantitative variables and not with qualitative variables. This was done based on the assumption that people use quantitative attributes of reasoning.

For example, "age" is a linguistic variable:

Age = {child, young, mature, adult, old}

$$FS := \sum_i x_i \cdot \mu_i$$

where **μ** is the coefficient of uncertainty or membership function, it shows the level of belonging to the fuzzy set (FS). In order to define fuzzy set, we require a basic discrete scale (in years, or kilograms, or meters, etc.).

This formula describes FS "Young age":

$$young_{FS} := \frac{1}{0.6} + \frac{5}{0.7} + \frac{10}{0.8} + \frac{15}{1} + \frac{20}{0.9} + \frac{25}{0.8} + \frac{30}{0.6}$$

Fuzzy set also may be presented as a plot. Fig. 9 illustrates FS "Child age"

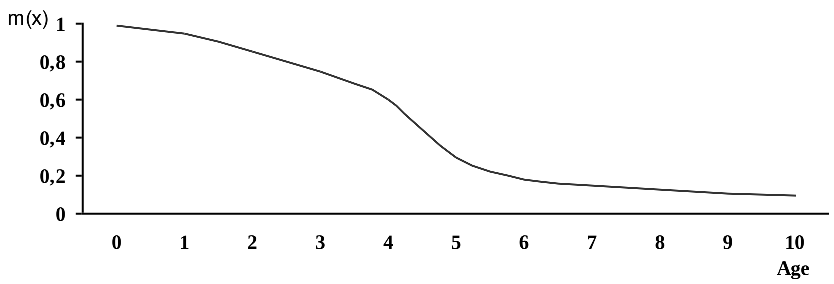


Fig.10. Example of a fuzzy set "Child age"

2.5. Example of an interview

Elicitation of Expert Knowledge Topic: *Traveling in Corsica*

By Marius Giwer as an analyst

Interviewee (Expert): *Thomas*

Elicitation-Technique: *Interview*

Date: *17.11.08* Duration: *35 min.*

Questions: Total: 15

Open questions: 11 Multiple Choice: 4

Personal: 3 Impersonal: 12

Direct: 12 Indirect: 3

Protocol:

1) Would you describe Corsica as a typical part of France?
☐ Yes ☒ No

2) What are the differences?
Isolated; Different History; Behavior; Pride;

3) How many times have you been there?
☐ 0 ☐ 1-3 ☐ 4-6 ☐ 7-10 ☒ >10

4) Mark the groups Corsica might be an attractive travel destination:
☐ Teenager ☒ Couples ☒ Families ☐ Seniors ☐ Individuals ☒ Dinks

5) Is it an expensive travel destination?
☒ Yes ☐ No

6) Describe the landscape:
Rockets, little beaches and raw sand (south), long beaches (north), dry climate

7) What does tourists like most at Corsica?
Beaches, Porto Vegio, Bonifazzio

8) Is it good for individual travelling?
No, too dangerous, Natureside is very raw and a lot of climate changes, Several tourists die every year, because underestimate climate.

9) Is it good for adventure travelling?
Its very interesting, because of versatile and intact nature.

10) Which sports could you practice at Corsica?
Skiing in winter (just small places), climbing, hiking, surfing, kite-surfing, swimming, snorkelling, waterskiing

11) List some cultural attractions:

Less museums, roman ruin (antique), beautiful countryside

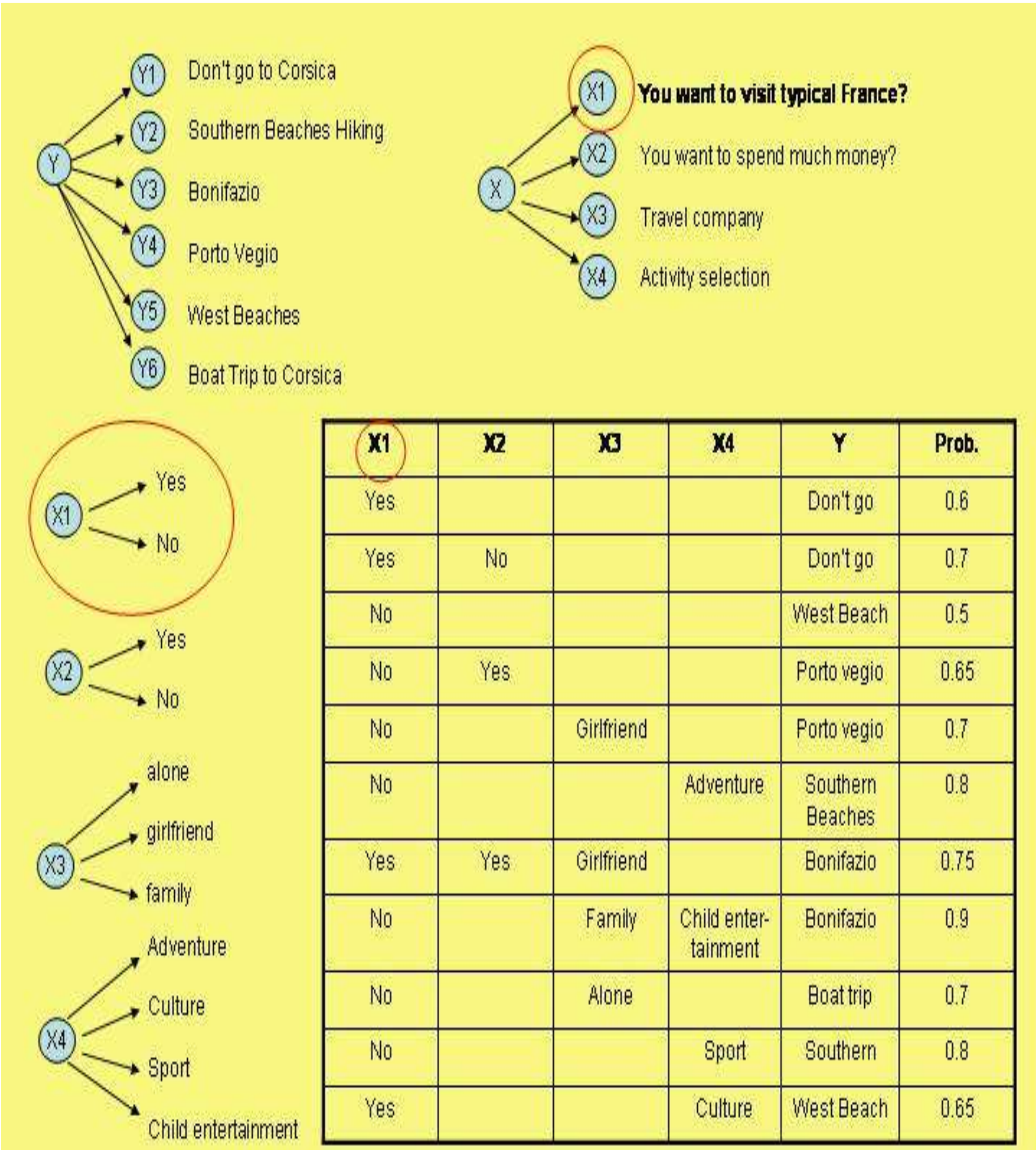
12) Which place would you recommend your friend?
Bonifazio

13) What is the best place to stay?
If money is not a problem, the best is to stay in a villa, or a house.

14) Where do the most tourists come from?
French and Italy, also some Germans

15) What else could you mention about Corsica?
You can reach it from the French coast with your boat, wonderful trip.

Thanks you, finish.



X1	X2	X3	X4	Y	Prob.
Yes				Don't go	0.6
Yes	No			Don't go	0.7
No				West Beach	0.5
No	Yes			Porto vegio	0.65
No		Girlfriend		Porto vegio	0.7
No			Adventure	Southern Beaches	0.8
Yes	Yes	Girlfriend		Bonifazio	0.75
No		Family	Child enter-tainment	Bonifazio	0.9
No		Alone		Boat trip	0.7
No			Sport	Southern	0.8
Yes			Culture	West Beach	0.65

Fig. 11. Decision table & conceptual structure

2.6. Ontologies (partly adapted from James Geller)

An ontology is an explicit specification of a conceptualization. A conceptualization is an abstract, simplified view of the world that we want to represent. If the specification medium is a formal language, the ontology defines a representational foundation. When we say "Ontology" we mean "Information Ontology." We don't mean philosophical ontology.

An Ontology is a graph (the data structure). Every node of this graph stands for a "concept." A concept is a unit that one can think about. Concepts correspond to words or short phrases. Typically, concepts correspond to nouns or noun phrases, but they don't have to. Examples: house, man, car, New York, World Trade Center

The nodes of the ontology are connected by different kinds of links. The most important kind of link is called IS-A (AKO) link. You know what "directed" means. In our definition, IS-A links point upwards. If an IS-A link points from a concept X to a concept Y that means that every real world thing that can be called an X also can be called a Y. In other words, every X IS-A Y. (Some people have IS-A-like links but pointing downwards.) Examples: A car IS-A vehicle. A dog IS-A animal. You will notice this is very similar to an Object-Oriented Database. There we had classes and subclass links. Even the diagrams are similar.

Acyclic means that if you start at one node and move away from it following an IS-A link, you can never return to this node, even if you follow many IS-A links. Most nodes also have other information attached. This information includes attributes, relationships and rules (or axioms).

An attribute is like a simple variable that contains additional information about that concept. Examples: An animal can have the attribute "legs" which can have values such as 0, 2, 4, 6, 8. A car can have the attribute color, which can be red, green, etc. A relationship is a link (arrow) that points from one concept to another concept. It expresses how the two concepts relate to each other. Relationships MAY form cycles. The name of a relationship is normally written next to the relationship link. Example: The concept Car may have a relationship to the concept Person. The name of that relationship could be "Owned." Commonly, IS-A links are also called "IS-A relationships."

The IS-A relationship can be used to inherit attributes and semantic relationships down (against the direction of the arrows) from higher nodes to lower nodes in the DAG. Example: If Vehicle has the attribute Price then Car would inherit Price. You don't have to specify that Car has Price.

There is some disagreement whether only the attributes are inherited or also the values of attributes. But, IF values are inherited, they may be "overridden" by attributes at lower nodes. Example: I could assign the value "4" to the attribute Legs at the concept Animal in an ontology. However, the child Bird of Animal could specify the value "2" for "Legs" and this would be the value that is used.

Higher nodes represent general concepts. Lower nodes represent specific concepts. Examples: Vehicle is more general than Car. Car is more general than Toyota. Animal is more general than Dog. Dog is more general than Collie.

Classification means that if we know the attributes of a concept we can decide under which other concepts it belongs in the ontology. Example (simplified): If we know an animal has 4 legs, black stripes, eats meat, runs very fast, and lives in Africa, it must be a tiger.

A concept may inherit information from several other concepts. This is called multiple inheritances. Multiple inheritances are important but may cause problems, such as apparent contradictions. Example: (Famous): President Nixon was a Quaker and a Republican. Quakers are considered "peaceful." Republicans are considered "in favor of war." If Nixon inherits from both Quaker and Republican, then, Is he peaceful or in favor of war? (This is called the Nixon Diamond. If you draw it, you see why.)

Transitivity reasoning corresponds to chaining of IS-A links. Example: If we know that a Collie IS-A Dog and we also know that a Dog IS-A Animal, then we can conclude that a Collie IS-A Animal.

People say that ontologies store "symbolic" knowledge. They don't mean symbols such as &$%#@. They mean "words." That means, they mean symbolic as opposed to "numeric."

Some people use other terms than IS-A. AKO (A kind of) and SUBCLASS are common. They call concepts "categories" or "classes" and mean more or less the same with those terms as "concepts."

Relations describe the interactions between concepts or a concept's properties. Relations also fall into several broad kinds [Gavrilova, Koshy, 2004]:

- **Taxonomies** organize concepts into sub- super-concept tree structures by using AKO-relation.
- **Partonomie**s use partitive relationships (has_ part) describe concepts that are parts of other concepts.
- **Attributive structures** describe main attributes or features of the concept.
- **Genealogies** use links as Father of or Predecessor of .

Examples of the ontologies are presented on Fig. 12-14.

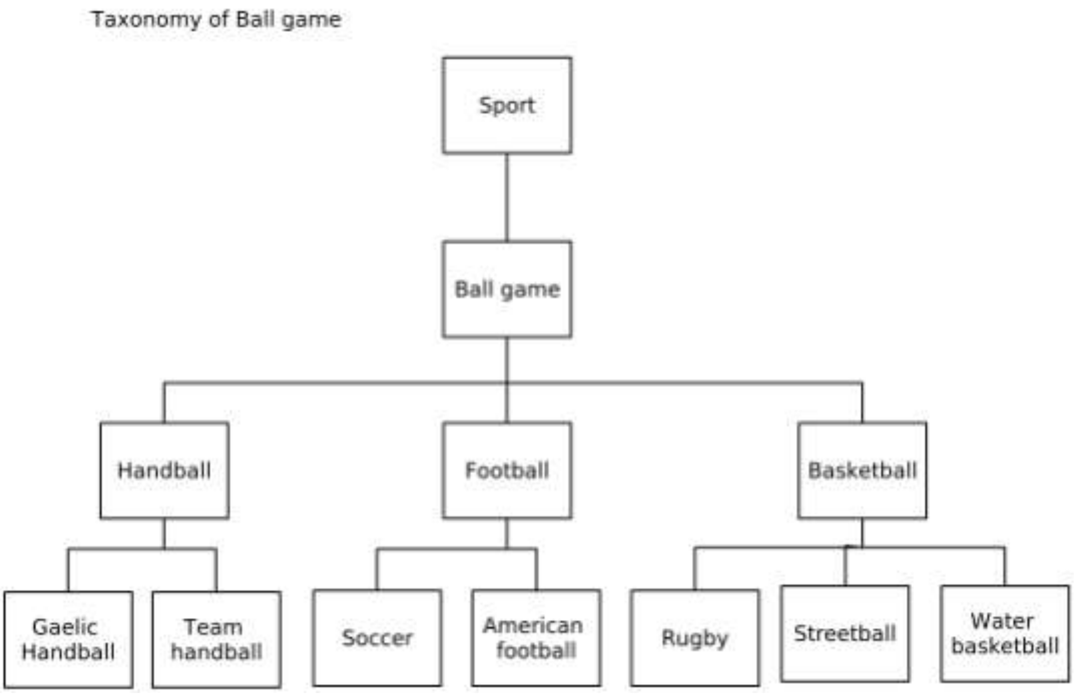


Fig. 12. Taxonomy example for sport games

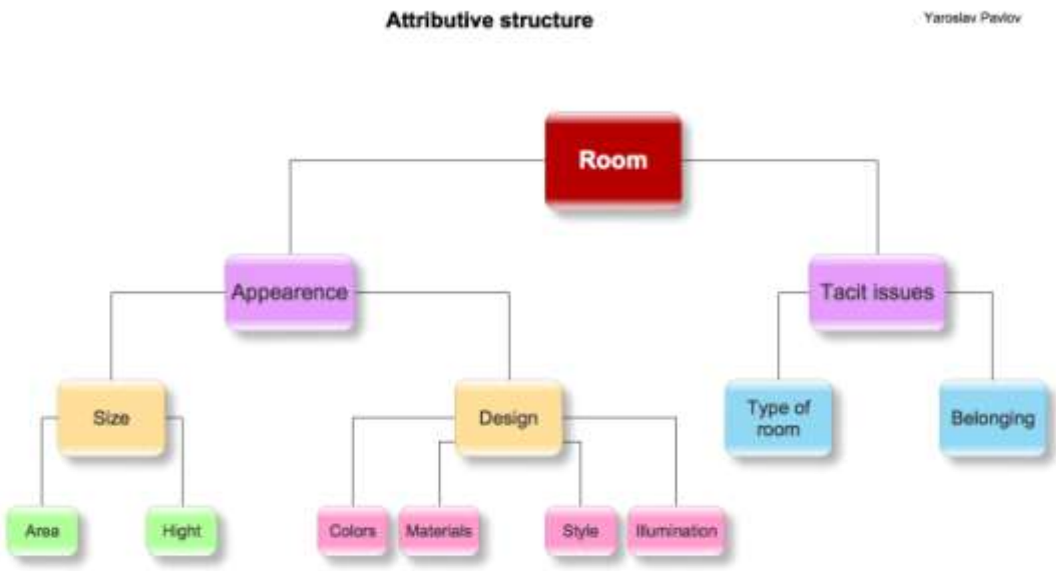


Fig. 13. Attributive structure of a room

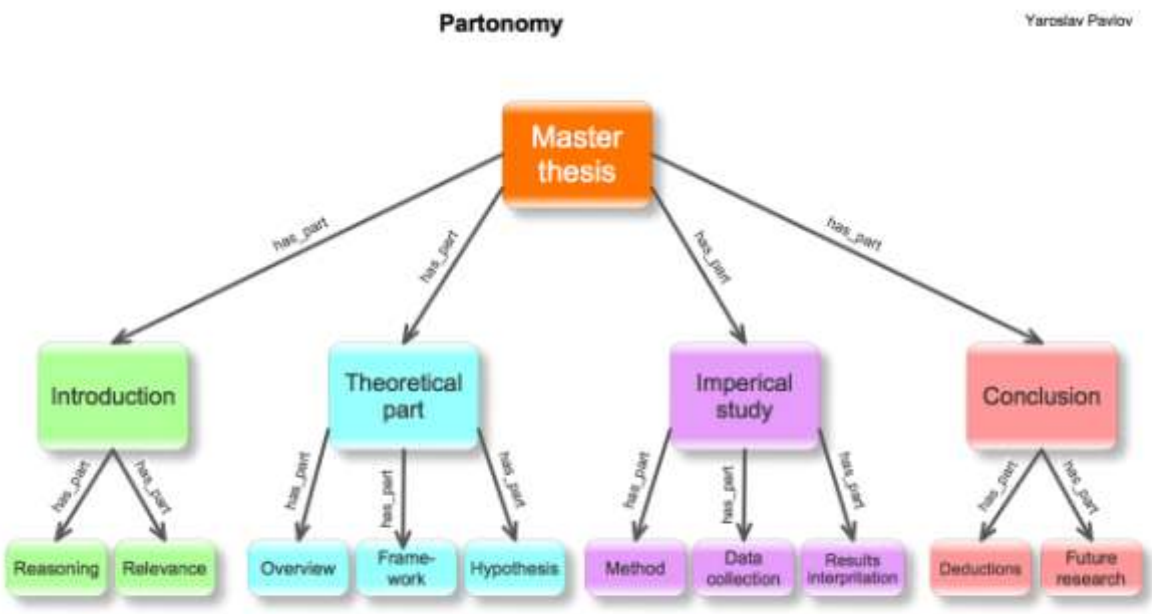


Fig. 14. Partonomy of Master Thesis

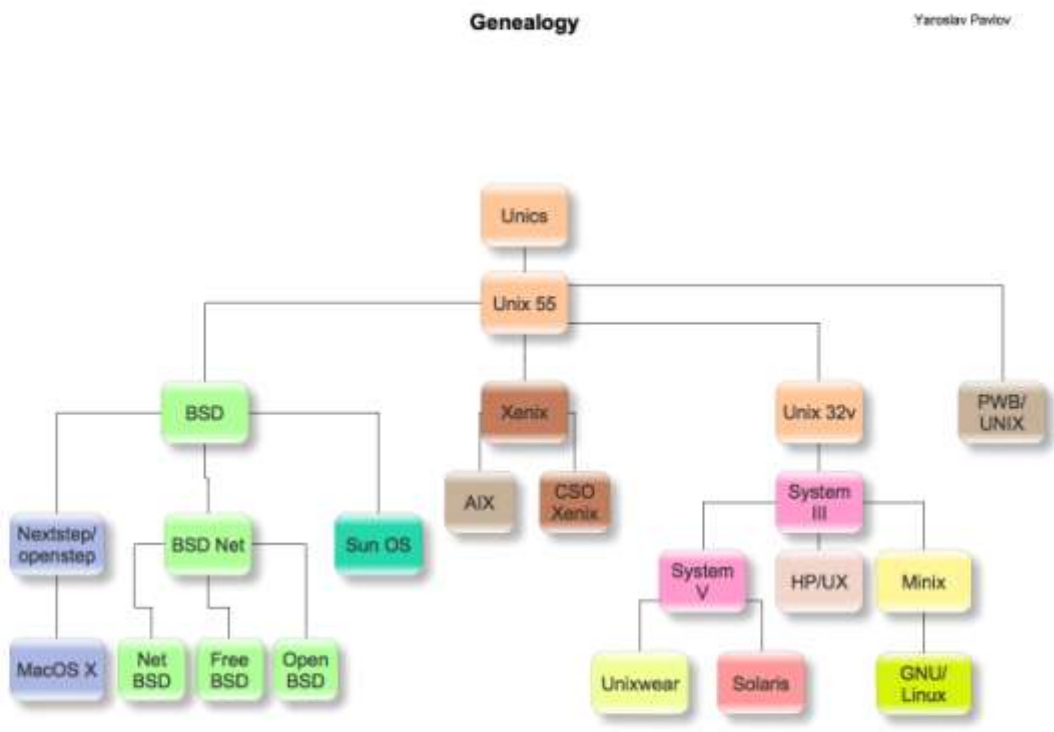


Fig. 15. Genealogy of OS

The use of ontology engineering also appears to amplify the benefits associated with structured approach. Major experts suppose that:

- Ontology is interdisciplinary.
- The demand for ontologists is expected to rise considerably, but employers cannot easily recognize qualified ontologists.
- There is a large gap between education needs and knowledge engineering education availability.
- Working professional managers have significant demand for training opportunities .
- Available training opportunities for professionals do not meet needs.
- Important subjects are absent from existing curricula.

Chapter 3

The list of personal assignments for E-portfolio

A1

1) 3 knowledge and 3 skills
2) Make INTENSIONAL AND EXTENSIONAL definitions of a concept (bird, book, bus, bag, etc.)
3) Present the text compression in a form of the word cloud made by Wordle .net
4) Draw A MIND MAP "My visual resume'
5) Draw A MIND MAP "Management'
6) Create A CONCEPT MAP for a sentence "John Brown goes to a short business trip to Moscow by train on May with his younger colleague Nick Adams"
7) Create A CONCEPT MAP "Birthday Party"
8) Create a DECISION TABLE "*What clothes to put on when going out?"*
9) Create a DECISION TREE *"Preparing a birthday party"*
10) Create a CAUSE-AND-EFFECT DIAGRAM of "History of computer science" or any other research field

A2

11) Work out the FRAME for a concept "Newspaper"
12) Make *a* FLOWCHART of " My breakfast" process
13) Make *a CAUSAL CHAIN* «Being Late to the Train"
14) Describe the *linguistic variable* "Price of a gift" as a group of fuzzy sets, and describe one set using the basic scale.
15) 40 properties of a "PEN" and conceptual structure
16) Extract knowledge from the given text
17) Conduct INTERVIEW, structure it in the form of conceptual structure and decision table
18) Create ONTOLOGY (taxonomy/partonomy/attributive structure/genealogy)

Lab

a. Do text compression with ***Wordle***.net
b. Make a visual draft of computer science history in ***Visio*** via cause–and effect diagram on the basis of main facts given in the task.
c. Use ***Freemind*** tool to design mind maps
   - visual CV
   - Management
d. d. Use ***Cmap*** tool for mapping a concept "Birthday party"

Analytical academic practice

- Abstract
- Reference list
- Presentation
- Paper

Chapter 4 Reading

Basic Reading

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Conclusion

All the visual models of knowledge are node-link representations in which ideas are located in nodes and connected to other related ideas through a series of labeled links. The research on knowledge mapping in the last decade has produced a number of consistent and interesting findings (O'Donell *et al.*, 2002; Dicheva, Dichev, 2007). Students recall more central ideas when they learn from mind map or ontology than when they learn from text and those with low verbal ability or low prior knowledge often benefit the most.

Learning from maps is enhanced by active processing strategies such as summarization or annotation and by designing maps according to gestalt principles of organization. Fruitful areas for future research on ontology mapping include examining whether visual representations reduce cognitive load, how map learning is influenced by the structure of the information to be learned, and the possibilities for transfer.

As a conclusion we can recommend some creative tips for making different knowledge models (This information comes from http://www.aldridgeshs.eq.edu.au/sose/mindmaps/tips.htm) :

- Review available visual materials such as photos, sketches, graphs, etc.
- Focus upon a visual language approach to communication.
- Consider possible formats for visual structuring.
- Relax, close your eyes and allow your mind to "free associate".
- Draw informal, thumbnail sketches of your visual impressions.
- Experiment with a variety of visual layout formats.
- Color shapes, arrows or words for emphasis.
- Imagine a bird's eye overview of the subject matter to be presented.
- Look with fresh eyes, is the visual presentation attractive?
- Ask yourself, are these visuals compelling? Do they help convince the viewer that the subject matter is important and inviting?
- Integrate the visuals with the text. Does it work to the best advantage?

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Appendices

Appendix 1

Mind Mapping Software

iMindmap. Excellent software from Tony Buzan, the originator of mind maps. IPhone app available.

MindManager. Professional software. Site has some good examples.

MindManuals Supplier of mind mapping software for MindManager.

MindPlugs. Plug-in for Mind Manager that allows live calculating of mathematical formulas.

MindMapper. Mindmapping software for Windows, and Palm

SmartDraw. Business graphics software that includes mindmapping and other functions.

MindGenius. Integrated with Microsoft Word, PowerPoint, Project Outlook.

ConceptDraw. Mac Classic and OS X versions also available.

FreeMind. Free software. Java based, so platform independent.

NovaMind. Excellent mindmapping software for Mac and Windows XP and Vista.

BrainMine Mindmapping software for Windows.

MyMind. Simple but versatile free software for Mac OS X.

Mind-Pad. Object-orientated mindmapping software for Windows.

DeepaMehta. Networked semantic desktop

i2Brain. Java, versatile mindmapping software

Inspiration. Mac and WIndows. Educational packages for kids and students.

MindVisualizer. New, straightforward Windows software, with many good features.

Mind42. Free collaborative online mindmapping software.

Mindomo. Web-based mind mapping tool. Create and edit mind maps in your web browser.

WiseMapping. A neat Web 2.0 mind map tool for creating mind maps on line.

SmartDraw. Graphic software with mind mapping capabilities.

MiindView. Matchware mindmap software for Windows with Microsoft Office integration.

Personal Memory Manager. Allows use of different "sheets" as way of organizing notes.

Cayra. PC software that combines mindmaps, concept and topic maps.

MindMeister. An online mind mapping tool, with as many simultaneous users as you like.

Wisdomap. Online mind mapping that includes multi-media and text attachments.

Meadmap. Online hierarchical note-taking system

DropMind. Online or stand-alone mind map with innovative visual qualities. Worth a look.

Spinscape. Web-based app for collaborative mindmapping.

XMind. Open Source brainstorming and mindmap app.

MindMapPaper. Straightforward mindmap tool for windows.

SciPlore Mindmapping. Aimed at needs of researchers. Allows import of PDF bookmarks, and reference keys (eg BibTex)

MindDecider. Integration of mind maps with multiple criteria analysis (MCDA) to aid decision making and project management.

Appendix 2

History of Computer science

Some facts from the history

1673

Gottfried Wilhelm von Leibniz, a German mathematician and philosopher, improved this by building a machine which could multiply.

1642

French scientist Blaise Pascal built the first adding machine, the predecessor of the digital computer. It used a series of 10-toothed wheels, representing 0-9. These were connected so that numbers could be added.

1822-1833

In Britain, Charles Babbage, "Father of the computer", designed Difference Engine to accurately compute entries in navigation and other tables, then he invented more complex device, the Analytical Engine that embodied most of the basic elements of the modern computer-including punched card input and output, arithmetic unit, memory for storing numbers and sequential control. But the steam-powered engine was never completed, mainly because metal parts could not be made with enough precision.

1854

George Boole, an English mathematician and logician, described his system for symbolic and logical reasoning that later becomes the basis for computer design.

1890

In the US, Herman Hollerith introduced punched cards in data processing. Possibly inspired by Jacquard of France, he invented a tabulating system to automate the census count. Its electromechanical sensing and punching devices were forerunners of modern peripheral computer equipment.

1946

The first generation of modern computers arrived with the completion of ENIAC (Electronic Numerical Integrator and Calculator). Developed by John Mauchly and Presper Eckert at the University of Pennsylvania, ENIAC was the first all-purpose, all-electronic digital computer. It had 18,000 vacuum tubes and could carry out several thousand multiplications a minute.

1930s

Konrad Zuse developed his Z-computers, which were used in World War Two by the German aircraft industry. The Z4 was used to develop a flying bomb carried by an aircraft and guided by radio. However, his design were unknown outside Germany until well after the war and had little influence on the computer's development.

1937

Alan Turing had conceived the idea of a Universal Machine to execute any describable algorithm was a key member of the decoding team.

1943

British computer - the Colossus - was in operation to decipher German codes. Its existence was kept a secret until 1970.

1947

The transistor was invented in the US at Bell Telephone Laboratories. Initially called the "transfer resistance" device, it eventually gave computers the reliability that could not be reached with vacuum tubes. The transistor was small, reliable, used little power and had a long life.

1948

The "Baby", built at the University of Manchester, was the world's first stored - program machine. The design, taken over by Ferranti, began a life of computers that became an important element in the UK industry.

Also in the 1940s, Howard Aiken of Harvard University built a machine from mechanical adding machine parts – this is generally considered the first digital computer. John von Neumann of Princeton University also had a substantial influence on computer design.

1951

The UNIVAC 1 (Universal Automatic Computer) was built by Eckert and Mauchly for the US census. This was the first digital computer to handle both numerical and alphabetical data with equal facility.

1951

First Russian (Soviet) computer MESM (МЭСМ) was built in the Electro-technical Institute. It was designed in the laboratory of the pioneer of Russian computer science - Sergey Lebedev in 1947.

1952

Grace Hopper, a pioneer in computer languages who had worked on the UNIVAC and was employed by Remington-Rand, Drew up the ideas for the first "compiler", enabling whole programs to be translated into machine language before execution. This speeded up computer operations. Her work contributed enormously to making computers more useful for business.

1957

IBM developed FORTRAN (formula translation), a first high level programming language, to simplify complicated mathematical formulae. Later developments were ALGOL (algorithmic language), COBOL (common business oriented language) – the first standardised business computer programming language -and BASIC (beginner's all-purpose symbolic instruction code), which was developed in the US for non-professional users. The microprocessor explosion of the 1970s and 1980s was based heavily on BASIC.

1958

Integrated circuits entered the computer scene. These made it possible for many transistors to be fabricated on one silicon wafer, with interconnecting wires. This led to further cuts in price,size and failure rates of components.

Later, in the mid-1970s, the large scale integrated circuit (LSI) made the microprocessor a reality. Then came the very large scale integrated circuit (VLSI), with many thousands of interconnected transistors etched onto a single silicon chip.

1964

IBM introduced the System/360, the first major main-frame family. This allowed the use of programming across multiple systems. IBM also merged its scientific and business lines of computers, thus influencing the way many companies regarded computers. This was the first large high-speed commercial computer/communications network that operated over telephone lines in "real time".

1971

The roots of personal computing were laid down with two significant products: the first commercially available microprocessor and the first floppy disk. Intel produced the Intel 4004, starting a family of "processors on the chip". The 8080 8-bit microprocessor followed in 1973.

1973

Internet technology was developed by Vinton Cerf, a US scientist as part of the US Department of Defense Advanced Research Projects Agency (DARPA). It was turned over to the private sector and the government research and scientific agencies for further development.

1975

The first mass produced and marketed personal computer, the MITS Altair 8800, was launched. Available as a kit or assembled, the Altair – named after a planet on a Star Trek episode – did not need an electrical engineering background. But it had no keyboard and no display.

1976

Microsoft and Apple founded. The Apple II was introduced – in assembled (not kit) form and complete with its own keyboard and monitor. It was an immediate success and taken up by many schools and colleges.

1979

The first PC modem was introduced by Hayes.

1981

First IBM personal computer launched.

1984

Apple Macintosh introduced.

1985

Microsoft introduced the first version of Windows. Intel brought out the 386 processor family; the 486 followed three years later. The more powerful Pentium came in 1993.

1989

The worldwide web was developed by Timothy Berners-Lee, an English computer scientist, for information to be shared among international teams at CERN (the European Organization for Nuclear Research) facility in Geneva.

This became the platform for related software development and the numbers of linked computers and users grew rapidly.

1994

The internet entered the commercial era. Yahoo! was founded by two Stanford University electrical engineering students as a online directory for web sites. Company initials stand for "yet another hierarchical officious oracle". Its 1996 stock market debut unleashed internet frenzy among investors.

Netscape, also founded in 1994, came to the market in 1996; its shares soared. The company's browser software simplified navigation of the web, but Microsoft soon made up lost internet ground with its own browser, Internet Explorer.

1995

Amazon.com sold its first book over the internet. America Online opened up its private network to the internet.

Information mapping software

3D concept and mind maps

1. 3D Topicscape Student Edition
2. Conspicio Mindmapper
3. Morcego 3D Network Browser

Concept maps

4. 3D Topicscape Student Edition
5. Bubbl.us
6. Cayra
7. CmapTools
8. CoFFEE
9. Compendium
10. Conzilla
11. Glinkr
12. Hypergraph
13. Labyrinth
14. LifeMap
15. Visuwords
16. VUE (Visual Understanding Environment)
17. yEd

Diagrams, Flowcharts

18. Creately
19. Dia
20. DrawAnywhere
21. Gliffy
22. GraphViz
23. ImaginationCubed
24. Thinkature
25. Project Draw
26. Dabbleboard
27. yEd

Hyperbolic trees

28. GraphViz
30. Hypergraph
31. Treeviz

Information & knowledge management

32. 3D Topicscape Student Edition
33. eyePlorer
34. Graph Gear
35. JSViz
36. Protégé-Frames (protege)
37. Protégé-OWL (protege)
38. Xebece +
39. Visuwords

Maps of Arguments, Belief, Idea support, Debates, Decisions and Influence

40. Argunet
41. Cohere
42. Debategraph
43. Prefuse

Concept maps or mind maps? the choice.

44. 3D Topicscape Student Edition
45. Bookvar
47. Cayra
49. CharTr
51. Creately
53. EDraw Mind Map
55. Ekpenso
56. FreeMind
57. Freeplane
58. Gliffy
59. Glinkr
60. Hypergraph
61. Kdissert
62. Mind42

63. Mind Map Viewer (Eric Blue)
64. MindNode
65. MindRaider
66. Semantik
67. Text2Mindmap
68. Thinkature
69. ThinkGraph
70. Thoughtex
71. Tomboy mindmap
72. VYM (View Your Mind)
73. WikiMindMap
74. WoW (Web of Web)
75. Xebece **+**
76. Xmind
77. XWiki MindMap

Ontologies and Taxonomies

78. Jambalaya
79. Protégé-OWL (protege)
80. Dendroscope

Presentations

81. VUE (Visual Understanding Environment)

Treemaps

82. Treeviz

Whiteboard

83. ImaginationCubed
84. Thinkature

Wiki-related

85. MindRaider
86. QwikiWiki
87. XWiki MindMap

With significant limitations in Free version

88. InfoRapid KnowledgeMap
89. Lovely Charts
90. MindMeister
91. Mindomo
92. PersonalBrain
93. Prezi
94. Wisdomap

Appendix 4

Text to create Genealogy

Smartphone

From Wikipedia, the free encyclopedia

A **smartphone** is a mobile phone offering advanced capabilities, often with PC-like functionality (PC-mobile handset convergence). There is no industry standard definition of a smartphone. For some, a smartphone is a phone that runs complete operating system software providing a standardized interface and platform for application developers. For others, a smartphone is simply a phone with advanced features like e-mail, Internet and e-book reader capabilities, and/or a built-in full keyboard or external USB keyboard and VGA connector. In other words, it is a miniature computer that has phone capability.

Growth in demand for advanced mobile devices boasting powerful processors, abundant memory, larger screens and open operating systems has outpaced the rest of the mobile phone market for several years.

History

The first smartphone was called Simon; it was designed by IBM in 1992 and shown as a concept product that year at COMDEX, the computer industry trade show held in Las Vegas, Nevada. It was released to the public in 1993 and sold by BellSouth. Besides being a mobile phone, it also contained a calendar, address book, world clock, calculator, note pad, e-mail, send and receive fax, and games. It had no physical buttons to dial with. Instead customers used a touch-screen to select phone numbers with a finger or create facsimiles and memos with an optional stylus. Text was entered with a unique on-screen "predictive" keyboard. By today's standards, the Simon would be a fairly low-end product; however, its feature set at the time was incredibly advanced.

The Nokia Communicator line was the first of Nokia's smartphones starting with the Nokia 9000, released in 1996. This distinctive palmtop computer style smartphone was the result of a collaborative effort of an early successful and expensive Personal digital assistant (PDA) by Hewlett Packard combined with Nokia's bestselling phone around that time and early prototype models had the two devices fixed via a hinge; the Nokia 9210 as the first color screen Communicator model which was the first true smartphone with an open operating system; the 9500 Communicator that was also Nokia's first cameraphone Communicator and Nokia's first WiFi phone; the 9300 Communicator was the third dimensional shift into a smaller form factor; and the latest E90 Communicator includes GPS. The Nokia Communicator model is remarkable also having been the most expensive phone model sold by a major brand for almost the full lifespan of the model series, easily 20% and sometimes 40% more expensive than the next most expensive smartphone by any major manufacturer.

The Ericsson R380, released in 2000, was the first phone sold as a 'smartphone'. The R380 had the usual PDA functions and the large touch screen was combined with an innovative flip so it could also be used as a normal phone. It was the first commercially available Symbian OS phone[1], however it could not run native third-party applications. Although the Nokia 9210 was arguably the first true smartphone with an open operating system, Nokia continued to refer to it and the following models as Communicator; only Ericsson referred to its product as 'smartphone' at this time.

In early 2002 Handspring released the Palm OS Treo smartphone, utilizing a full keyboard that combined wireless web browsing, email, calendar and contact organizer, with mobile third-party applications that could be downloaded or synced with a computer.

In 2002 the new joint venture Sony Ericsson released the P800 smartphone, originally developed by Ericsson. It was based on Symbian OS and had full PDA functionality plus a range of features not commonly seen in mobile phones at that time: color touch screen, camera, polyphonic ring tones, email attachment viewers, video playback and an MP3 player with a standard 2.5 mm headset jack.

In 2002 RIM released the first BlackBerry which was the first smartphone optimized for wireless email use and has achieved a total customer base of 32 million subscribers by December 2009.

Although the Nokia 7650, announced in 2001, was referred to as a 'smart phone' in the media, and is now called a 'smartphone' on the Nokia support site, the press release referred to it as an 'imaging phone'. Handspring delivered the first widely popular smartphone devices in the US market by marrying its Palm OS based Visor PDA together with a piggybacked GSM phone module, the VisorPhone. By 2002, Handspring was marketing an integrated smartphone called the Treo; the company subsequently merged with Palm primarily because the PDA market was dying but the Treo smartphone was quickly becoming popular as a phone with extended PDA organizer features. That same year, Microsoft announced its Windows CE Pocket PC OS would be offered as "Microsoft Windows Powered Smartphone 2002". Microsoft originally defined its Windows Smartphone products as lacking a touchscreen and offering a lower screen resolution compared to its sibling Pocket PC devices. Palm then introduced a few Windows Mobile smartphones alongside the existing Palm OS smartphones, and has now abandoned both platforms in favor of its new Palm webOS.

In 2005 Nokia launched its N-Series of 3G smartphones which Nokia started to market not as mobile phones but as multimedia computers.

Out of 1 billion camera phones to be shipped in 2008, smartphones, the higher end of the market with full email support, will represent about 10% of the market or about 100 million units.[*citation needed*]

The Smartphone Summit semi-annual conference details smartphone industry market data, trends, and updates among smartphone related hardware, software, and accessories.

Android, a cross platform OS for smartphones was released in 2008. Android is an Open Source platform backed by Google, along with major hardware and software developers (such as Intel, HTC, ARM, Motorola and eBay, to name a few), that form the Open Handset Alliance.

The first phone to use the Android OS was the HTC Dream, branded for distribution by T-Mobile as the G1. The phone features a full, capacitive touch screen, a flip out QWERTY keyboard, and a track ball for navigating web pages. The software suite included on the phone consists of integration with Google's proprietary applications, such as Maps, Calendar, and Gmail, as well as Google's Chrome Lite full HTML web browser. Third party apps are available via the Android Market, including both free and paid apps.

In July 2008 Apple introduced its App Store with both free and paid applications. The app store can deliver smartphone applications developed by third parties directly to the iPhone or iPod Touch over wifi or cellular network without using a PC to download. The App Store has been a huge success for Apple and by March 2010 hosted more than 170,000 applications.[25] The app store hit three billion application downloads in early January 2010.

Following the popularity of Apple's App Store, many other mobile platforms are following Apple with their own application stores. Palm, Microsoft and Nokia have all announced they will launch Apple-like app stores. RIM recently launched its app store, BlackBerry App World.

In January 2010, Google launches Nexus One using its Android OS. Although Android OS has a multi-touch capabilities, Google initially removed that feature from Nexus One, but it was added though a firmware update on February 2, 2010 .