Department of Computer Science
Technical University of Cluj-Napoca

Intelligent Systems

Laboratory activity 2016-2017

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Tool: Belief and Decision Networks - Version 5.1.10

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Contents

Chapter 1

Installing the tool (W_1)

The teaching objectives for this week are:

1. To know how to use the tool in our future project.

2. To know from where we can download it, what version, etc. And how to run it.

Steps for installing the tool on windows or mac:

1. First step is to go on the application site

2. Then you need to go on download part of the site.

3. Under Belief and Decision Networks you should download the latest version[jar download].

- Some notes, you should have java installed prior to running the application, otherwise it won't work.

Chapter 2

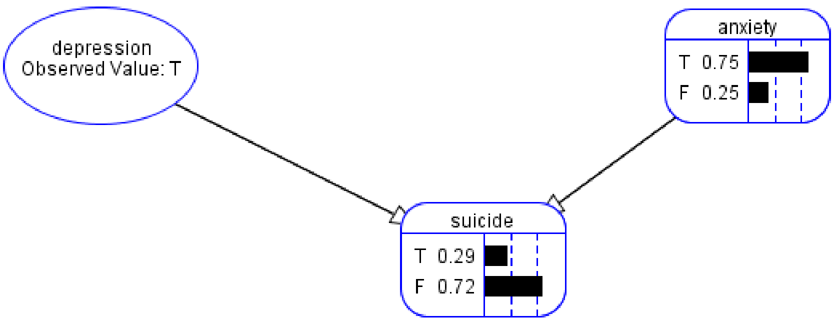
Running and understanding examples (W_2)

The teaching objectives for this week are:

1. To run and understand the some examples made by me.
2. To identify what realistic problems are adequate for my tool.

- First example

  The statistics shows that if a person is depressed and has anxiety , there is a 30 per cent change of it to commit suicide,where depression contributes 80has a change of 5



Formulas and probability calculated:

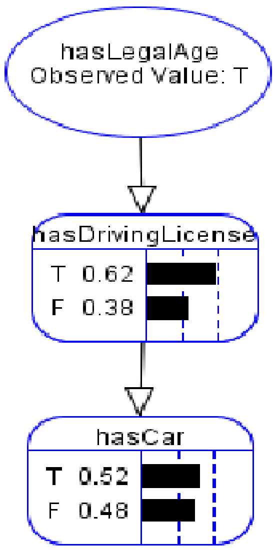
p(s) = p(s/depr,anx) * p(dep) * p(anx) + p(s/depr,-anx) * p (depr) * p(-anx) =

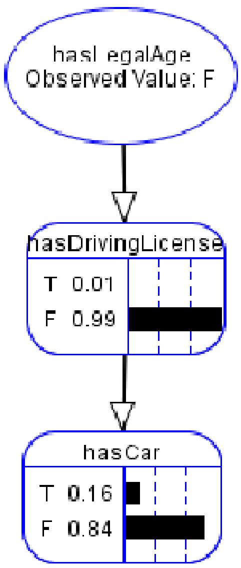
= 0.3 * 1 * 0.2 + 0.8 * 1 * 0.25 = 0.09 + 0.2 = 0.29

ConclusionIn the query shown up, we assumed that the person has depression and it might have a 75 per cent change to have anxiety. There will be 29 per cent probability that the person will commit suicide.

- Second example

    The probability of a person to have a car is the following. There is a 75 per cent change for a person with driving license to have a car,15 percent if he/she dosen't. There is a 62 per cent of change of people to have a driving license if they are of legal age,but some can aquirre with the prob of 0.01 per cent a fals driving license, even thou they are not of legal age. [1]



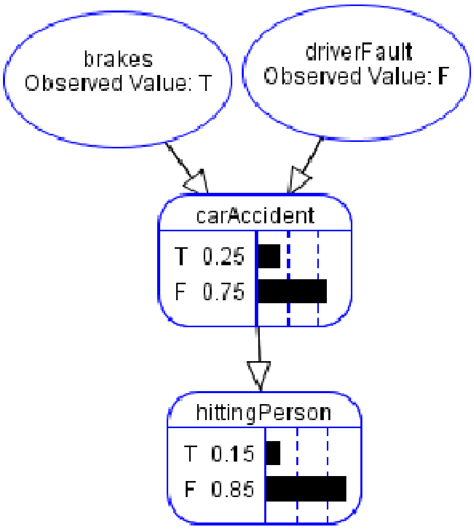


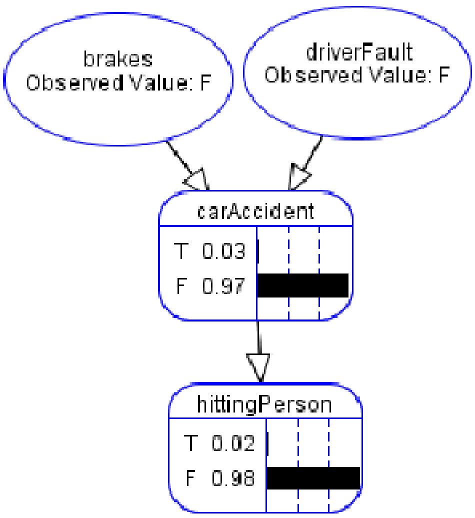
Conclusion If we asume that the person has legal age , we see that there is a 52 per cent probability of a person to have a car.If the person is not legal aged there is a 16 per cent probability of having a car.

- Third example

[1]https://math.stackexchange.com/questions/408082/conditional-probability-question-about-students-owning-cars-and-bikes

The probability of hitting a person is given by the probability of having a car accident, which is given by the brakes fails 25 per cent, driver fault 36 per cent. Not having breaks and dirver fault still puts a random person in danger by 3 per cent.If car is having an accident there is a 60 per cent prob of hitting a person, if it isn't there is only .001 per cent.

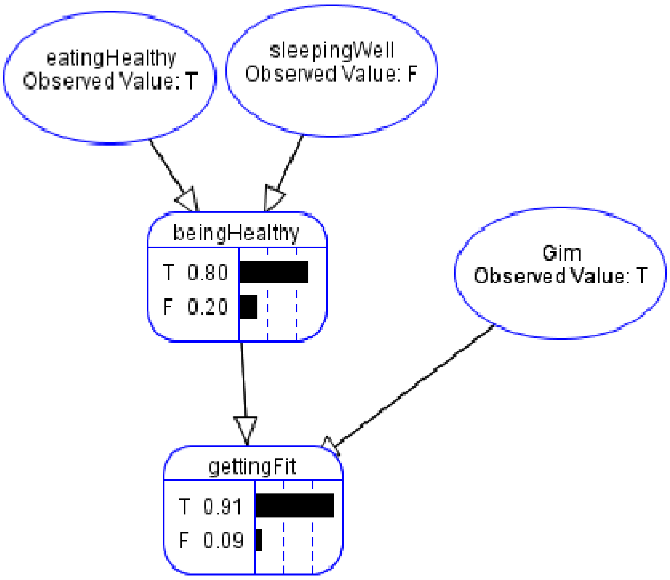


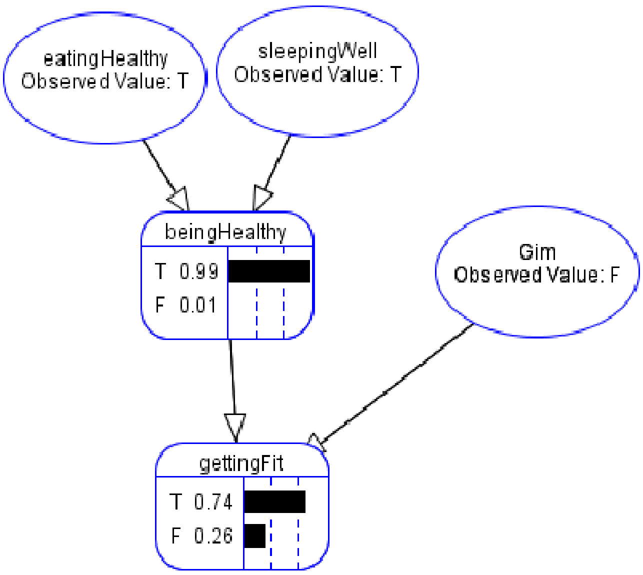


Conclusion If we assume that the brake missfunctioned but driver didn't made any more faults, there is a 15 per cent probability of hitting a person. But, if the breaks were ok and the drive didn't make a mistake, there is a 2 per cent probability of hitting a person.

- Fourth example

  The probability of getting fit will depend on the probability of hitting the gym(60) and the probability of being healthy(75). Being healthy will depend on how much healthy you eat(80) and how much sleep you get(60 ps)





Conclusion If we asume that the person will eat healthy but he won't be sleeping well. The person will go to the gym. There is a 91 probability of him getting fit.But if he eats healthy and sleeps well , but dosen;t go to the gim , he will have a 74 per cent change of getting fit.

Chapter 3

Understanding conceptual instrumentation (W_3)

The teaching objectives for this week are:

1. To understand the algorithm(s) on which your tool relies.

2. To get used with writing algorithms in Latex

- Explaining the tool

  The Bayesian Belief and Decision Networks applet is a tool to visually solve Bayesian Nets. It has a robust variable elimination algorithm, and allows users to create their own networks and customize the domains and probabilities. The applet has features that allow the user to inspect probabilities, make observations, and monitor nodes. It also allows the user to manually do variable elimination and to inspect the factors created. [1]

  The applet also has features to add no-forgetting arcs. There is an independence quiz mode that tests the user on his or her knowledge of the independence rules of Bayesian Nets.

  The applet can read an XML representation of a Bayesian Network called the XMLBIF format. The application version of the applet saves networks in this format

  The Verbose Query Window allows the user to manually execute variable elimination. It has a large canvas area to the right and a control panel on the left.

  During the "Eliminate Variables" stage, there are two ways in which you can choose variables to eliminate. The 'Auto-Eliminate' button will eliminate all the variables in the order specified by the heuristic which is specified by the drop down menu next to 'Heuristic:'. The available heuristics are 'Max-Cardinality', 'Min-Degree', 'Min-Factor', 'Min-Fill', 'Random', and 'Sequential'. The 'Eliminate Next' button will eliminate a single variable each time you press it. The second way to choose variables to eliminate is by clicking on them directly. When you eliminate a variable, it will be greyed out, and the lists of current and eliminated factors will be updated accordingly. [2]

[1] http://www.aispace.org/bayes/help/general.shtml
[2] http://www.aispace.org/bayes/help/general.shtml

- Algorithm of eliminating variables is:

function ELIMINATION-ASK(X, **e**, bn) **returns** a distribution over X
  inputs: X, the query variable
    e, observed values for variables **E**
    bn, a Bayesian network specifying joint distribution $\mathbf{P}(X_1, \ldots, X_n)$

  factors ← [ ]
  for each var **in** ORDER(bn.VARS) **do**
    factors ← [MAKE-FACTOR(var, **e**)|*factors*]
    if var is a hidden variable **then** *factors* ← SUM-OUT(var, *factors*)
  return NORMALIZE(POINTWISE-PRODUCT(*factors*))

Figure 14.11 The variable elimination algorithm for inference in Bayesian networks.

Chapter 4

Project description (W_4)

The teaching objectives for this week are:

1. To have a clear description of what you intend to develop.
2. To point to specific resources (datasets, knowledge bases, external tools) that support the development of your idea and which minimise the risk of failure.
3. To identify related work (articles) that are relevant or similar to your approach.

4.1 Describe in natural language

We propose to determin some infectious diseases of pacients coming to a clinic and what is the probability of them diying. This represents a strong modality to determine the correct diagnostic ,which offers, besides the knowledge and experience of a doctor, a strong mathematical history cumulated togheter to help them.

We will model the network starting from an example wich can be found at the following address where is presented an example taken for another diseases. The nodes will be choosen depending on our scope wich is to diagnose the patient illness wich arrives at a clinic or hospital with some affections like fever, vomiting states or muscle pain. We will determine based on this symptoms the probability of the patien to hase some specific desease. The nodes of the graph will be chosen so as to encompass the most relevant causes like if the person has been in contact with sick people, is abusing of certain substances, or has been in some regions where are registered many cases the respective desease. Besides these, will result a set of another symptoms relevant to another deseases wich can occure if the illness is not treated.

At the top level we have the nodes Vizita Africa with the probability of a person visiting Africa of 0.007, with 56 million tourists every year, Contact cu persoane bolnave, with a probability of 0.2, and consum alcool/tutun, with 30pc of world population smoking and 30pc consuming alcohol daily. Those are independent nodes. A person visiting Africa can get two deadly deseases: Malaria or Yellow Fever, wich are caused by the bite of two types of mosquitoes. Every year are registered around 216 million of malaria cases, 90pc of them being in Africa, and that gives as the probability of a person getting malaria of 0.15. From the node Contact cu persoane bolnave will result flu or laryngitis wich can be caused by some type of viruses. 5 to 20pc of population is getting flu every year and 3.47 in 1000 suffers from laryngitis. Laryngitis can be also produced by alchohol and

tobacco consumption. The main symptoms of malaria are coma, vomiting stats and fever. Fever is also caused by yellow fever wich is where the name comes from. Every year are registered aroung 170.000 case of yellow fever, wich gives the probability of getting yellow fever of 0.00013, raported to the population number. Flu is causing fever, pneumonia, cough or breathing problems. The main symptom of laryngitis is breathing problemes. At the bottom is de death node. A person can die of some of the deseases mentioned above.

African turism

One of the diseases we try to diagnosticate in this project is malaria. This represents an ifectious disease, largely spread across tropical and subtropical regions. We tried to get the number of persons, which visits annualy Africa and the number of contaminated persons with this disease. Based on statistics, Africa has a anual turism of 56 millions of people. It results that the probability of viziting Africa is =56 mil/7.5mild = 0.007.[1]

Malaria

International travellers could be at risk of malaria infection in 91 countries around the world, mainly in Africa, Asia and the Americas. People infected with malaria often experience fever, chills and flu-like illness at first. Left untreated, the disease can lead to severe complications and, in some cases, death. Malaria symptoms appear after a period of 7 days or longer. Fever occurring in a traveller within 3 months of possible exposure is a medical emergency that should be investigated immediately.

Malaria is caused by the Plasmodium parasite and is transmitted by female Anopheles mosquitoes which bite between dusk and dawn. There are 5 different types of parasites that infect humans: P. falciparum, P. vivax, P. ovale, P. malariae, and P. knowlesi. Of these, P. falciparum and P. vivax are the most prevalent, and P. falciparum is the most dangerous, with the highest rates of complications and mortality. This deadly form of malaria is a serious public health concern in most countries in sub-Saharan Africa.

WHO estimates that 216 million cases of malaria occurred worldwide in 2016 (uncertainty range: 196–263 million) and about 445 000 people died from the disease (uncertainty range: 402 000–486 000), mostly children under 5 years of age in sub-Saharan Africa. Most of the cases in 2015 were in the WHO African Region (90), followed by the WHO South-East Asia Region (7) and the WHO Eastern Mediterranean Region (2). [2]

According to a recent report published by the World Health Organization, malaria was responsible for the deaths of 445,000 people in 2016, with 91 per cent of fatalities occurring in Africa. [3]

Of the 216 million malaria cases reported in the same year, 90 per cent occurred in Africa. Statistics like these prove that malaria is one of the continent's most deadly diseases - and as a visitor to Africa, you are also at risk. However, with the right precautions, the chances of contracting malaria can be reduced significantly. If there are 216 million cases of malaria and 90per cent of them are in Africa, then 0.9 * 216 million = 194.4 million cases of malaria in

[1]https://qz.com/1023064/africa-is-welcoming-more-tourists-than-ever-before/

[2] http://apps.who.int/iris/bitstream/handle/10665/252038/9789241511711
-eng.pdf;jsessionid=85E7F9D4B20BB3EF77A00BBE23D7231D?sequence=1 (page XVII).
http://www.who.int/malaria/travellers/en/
-http://www.africatravelresource.com/malaria-in-africa/

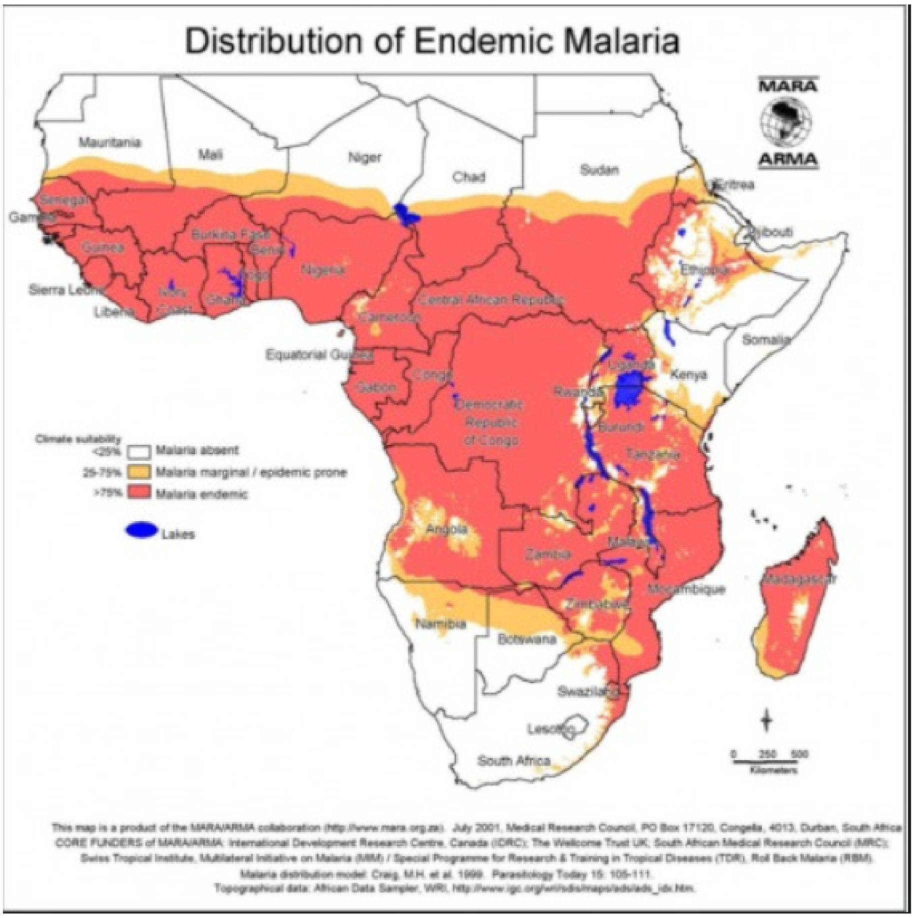
[3]https://www.tripsavvy.com/avoid-malaria-when-traveling-in-africa-1454332

Africa. From this probability we can get the probability of getting malaria if you go in Africa:

=¿ p(M—A) = 194.4 mil / 1.26 bil. = 0.15,

1.26 bil. being the population of Africa.

According to statistics recorded over several decades, the likelihood of a person being infected with malaria if he did not visit Africa is 2 per cent.



Yellow Fever

Yellow fever is caused by the yellow fever virus, which is carried by mosquitoes. It is endemic in 33 countries in Africa and 11 countries in South America. The yellow fever virus can be transmitted by mosquitoes which feed on infected animals in forests, then pass the infection when the same mosquitoes feed on humans travelling through the forest. The greatest risk of an epidemic occurs when infected humans return to urban areas and are fed on by the domestic vector mosquito Aedus aegypti, which then transmits the virus to other humans.

Symptoms of yellow fever include fever, headache, jaundice, muscle pain, nausea, vomiting and fatigue. A small proportion of patients who contract the virus develop severe symptoms and approximately half of those die within 7 to 10 days.

The virus is endemic in tropical areas of Africa and Central and South America. Large epidemics of yellow fever occur when infected people introduce the virus into heavily populated areas with high mosquito density and where most people have little or no immunity, due to lack of vaccination. In these conditions, infected mosquitoes of the Aedes aegypti specie transmit the virus from person to person.

Yellow fever is prevented by an extremely effective vaccine, which is safe and affordable. A single dose of yellow fever vaccine is sufficient to confer sustained immunity and life-long protection against yellow fever disease and a booster dose of the vaccine is not needed. The vaccine provides effective immunity within 30 days for 99 per cent of persons vaccinated. [4]

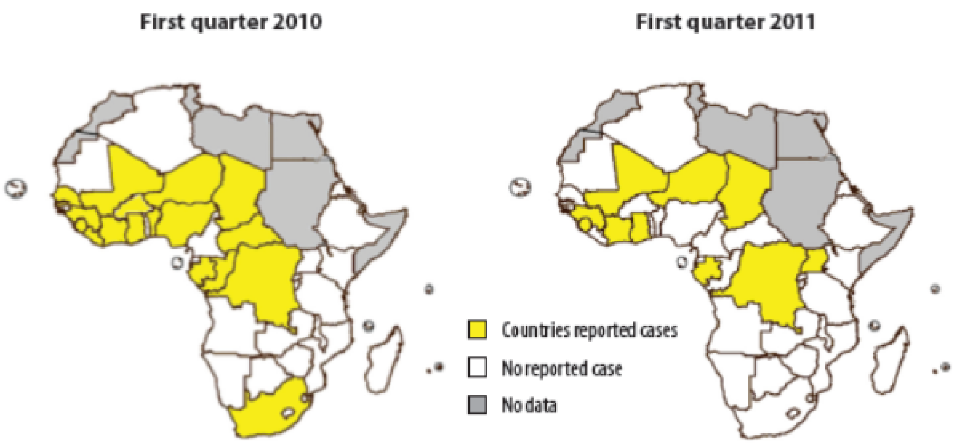
Forty seven countries in Africa (34) and Central and South America (13) are either endemic for, or have regions that are endemic for, yellow fever. A modelling study based on African data sources estimated the burden of yellow fever during 2013 was 84 000–170 000 severe cases and 29 000–60 000 deaths.

There are 170.000 cases of yellow fever anually in Africa, and to get the probability of yellow fever occuring, we divide the number of registered cases to the Africa's population:

$$\mathbf{p(FG/A) = 170.000/1.26\ mild = 0.00013}$$

The probability to get yellow fever if you not vizit Africa is very small : 0.00001.

Figure 4. Countries that reported clinical cases of yellow fever in the first quarters of 2010 and 2011



Contact with sick people

We assume that the probability to get contact with sick people is 20 per cent during daily activities.

Alcohol and smoking

• About a third of the male adult global population smokes.
• Smoking related-diseases kill one in 10 adults globally, or cause four million deaths. By 2030, if current trends continue, smoking will kill one in six people.
• Every eight seconds, someone dies from tobacco use.
• Smoking is on the rise in the developing world but falling in developed nations. Among Americans, smoking rates shrunk by nearly half in three decades (from the mid-1960s to mid-1990s), falling to 23 pc of adults by 1997. In the developing world, tobacco consumption is rising by 3.4pc per year.
• About 15 billion cigarettes are sold daily - or 10 million every minute.

[4] http://www.who.int/mediacentre/factsheets/fs100/en/

• About 12 times more British people have died from smoking than from World War II.
• Cigarettes cause more than one in five American deaths.
• Among WHO Regions, the Western Pacific Region* - which covers East Asia and the Pacific - has the highest smoking rate, with nearly two-thirds of men smoking.
• About one in three cigarettes are consumed in the Western Pacific Region.
• The tobacco market is controlled by just a few corporations - namely American, British and Japanese multinational conglomerates.

```
The proportion of the population who consumed alcohol daily declined between
 2007 (8.1%) and 2010 (7.2%) 1.
•  A higher proportion of 12-17 year olds abstained from alcohol (61.6%) than
had consumed it in the last 12 months (38.4%) 1.
•  The proportion of 12-15 year olds and 16-17 year olds abstaining from alcohol
 increased in 2010 (from 69.9% in 2007 to 77.2% in 2010 and from 24.4% to 31.6%, respect
•  In 2010, 1 in 5 people aged 14 years or older consumed alcohol at a level that
put them at risk of harm from alcohol-related disease or injury over their lifetime, and
stable between 2007 (20.3%) and 2010 (20.1%). However, the number of people drinking in
quantities increased from 3.5 million in 2007 to 3.7 million in 2010 1.
•  About 2 in 5 (39.7%) people aged 14 years or older drank, at least once in
 the last 12 months, in a pattern that placed them at risk of an alcohol-related injury
drinking occasion; but there was a modest by statistically significant decline in risky
 12 months from 2007 (41.5%) 1.
•  Males were far more likely than females to consume alcohol in risky quantities,
and those aged between 18-29 years were more likely than any other age group to consume
alcohol in quantities that placed them at risk of an alcohol-related injury, and of alco
harm over their lifetime 1.
•  The proportion of pregnant women abstaining during pregnancy increased in 2010 (from
% in 2007 to 52% in 2010).
```

According to world-wide statistics, about 7pc of the population regularly consume alcoholic and 30 pc of them tobacco.

Coma

The outcome of a patient can be associated with their best response in the first twenty-four hours after injury. Using the Glasgow Coma Scale (3 to 15, with 3 being a person in a coma with the lowest possible score, and 15 being a normal appearing person) research shows that if the best scale is 3 to 4 after twenty four hours, 87pc of those individuals will either die or remain in a vegetative state and only 7pc will had a moderate disability or good recovery. In patients with a scale from 5 to 7, 53pc will die or remain in a vegetative state, while 34pc will have a moderate disability and/or good recovery. In patients with a Glasgow Coma Scale of 8 to 10, 27pc will die or remain in a coma, while 68pc will have a moderate disability and/or good recovery. In patients who have a scale from 11 to 15, only 7pc will be expected to die or remain in a coma, while 87pc would expect to have at least a moderate disability and/or good recovery (remembering again that this is not an exact science).[5]

Influenza Influenza is an acute viral infection that primarily attacks the upper respiratory tract, including the nose, throat, bronchi and, less frequently, the lungs. The disease occurs worldwide and spreads very quickly in populations, especially in crowded circumstances.

[5]http://www.braininjury.com/coma.shtml

In the northern hemisphere, annual influenza epidemics occur during autumn and winter affecting approximately 5-20pc of the population.

5 to 20pc – Percentage of the U.S. population that will get the flu, on average, each year.

200,000 – Average number of Americans hospitalized each year because of problems with the illness

3,000 to 49,000 – Number of people who die each year from flu-related causes in the U.S.

10 billion+ – Average costs of hospitalizations and outpatient doctor visits related to the flu.

1 to 4 days – Typical time it takes for symptoms to show up once you've caught the virus. Adults can be contagious from the day before symptoms begin through 5 to 10 days after the illness starts.[6]

According to statistics, inluenza affects 12pc of people who make contact with other sick people. In the other cases, influenza affects approximately 4pc of the people.

p(G—CPB) = 12pc , P(G—-CPB) = 4pc , where G represents influenza and CPB represents contact with sick people.

Laryngitis

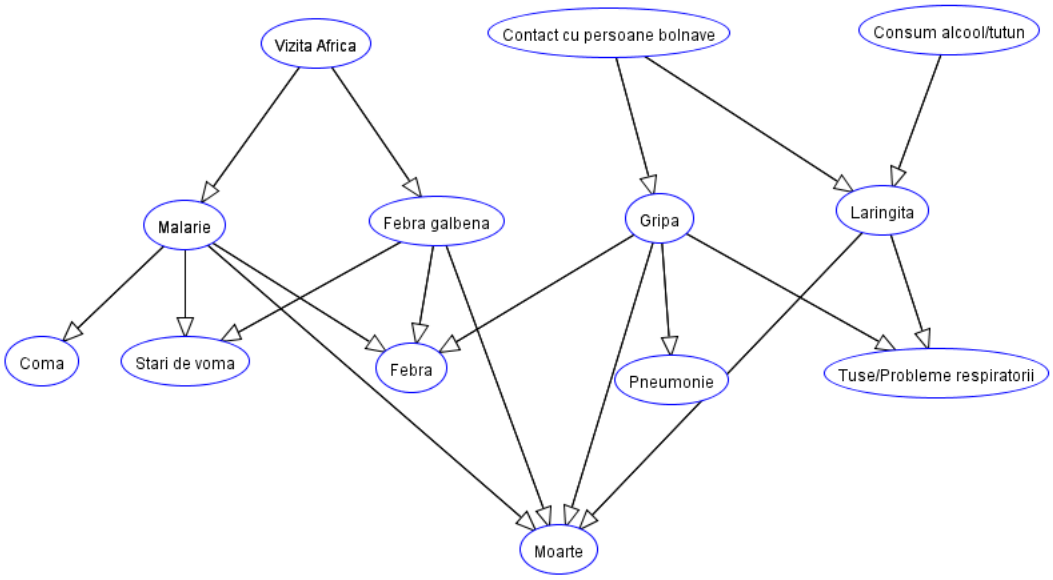
METHODS: We retrospectively identified patients with a diagnosis of CL who were seen among a primary care cohort at an urban academic medical center from 2009 to 2010. The incidence of CL was calculated. Symptoms, first-visit treatment, smoking, and demographics were recorded. RESULTS: Of a population of 40,317 people, 280 received a new diagnosis of CL over a 2-year period, representing a yearly incidence of 3.47 cases per 1,000 people. The subjects consisted of 160 women and 120 men. Race was recorded as black (126), Hispanic (47), white (68), or other (39). The mean age was 52.9 years (range, 20 to 90 years). The initial therapies included proton pump inhibitors (79pc, voice therapy (17pc), nasal steroid (13pc), antihistamine (4pc), amitriptyline (4pc), other (17pc), and none (11pc). The most common symptoms were dysphonia (53pc), pain/soreness (45pc), globus sensation (40pc), cough (33pc), excessive throat clearing (28pc), and dysphagia (32pc). An otolaryngologist saw 93pc of the cases.

CONCLUSIONS: The yearly CL incidence was 3.47 per 1,000 people. Up to 21pc of the population may develop CL in their lifetime. Most of the patients in this cohort were referred to otolaryngologists, and the majority were treated with proton pump inhibitors. Dysphonia, globus sensation, and pain were the most common symptoms. Population surveys could be used to define undiagnosed disease and the overall prevalence of CL.

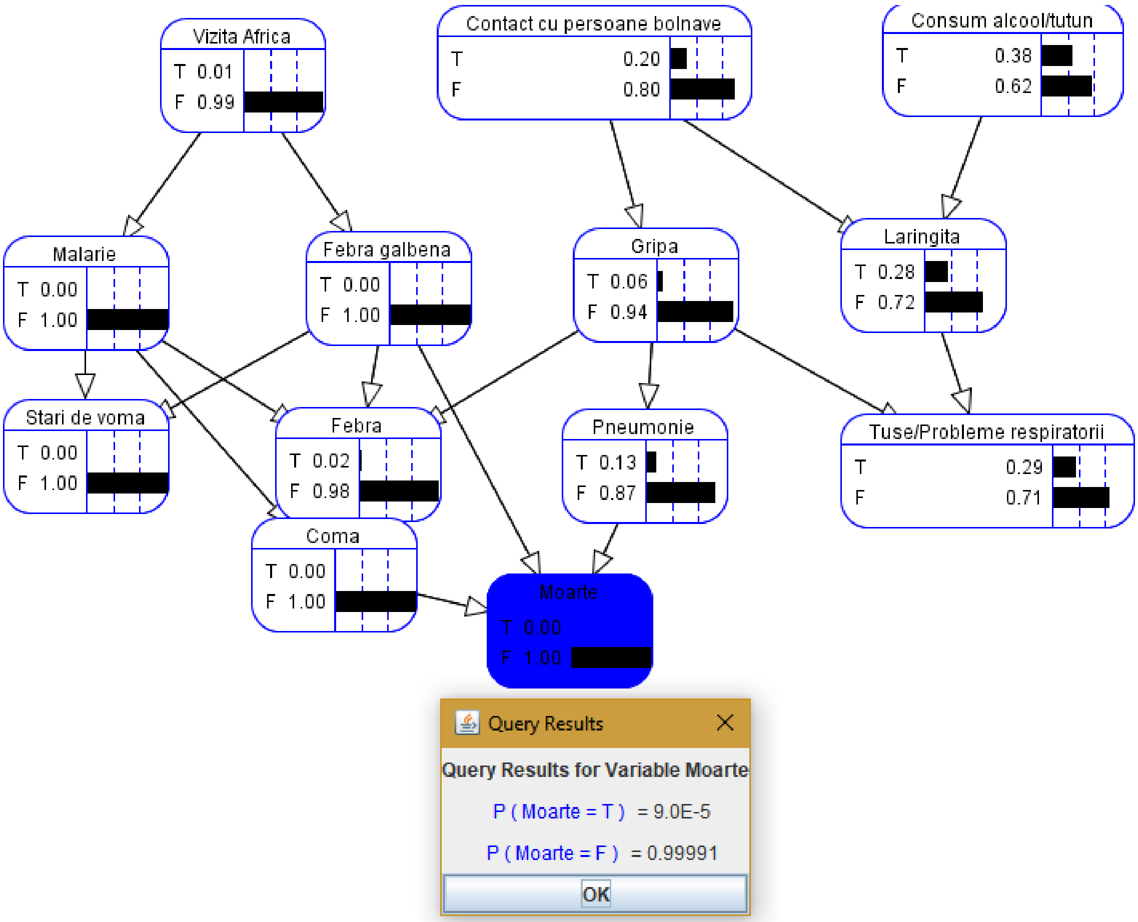
4.2 Querries and diagram

The diagram of all the nodes and combinations of those is here.

[6]http://www.euro.who.int/en/health-topics/communicable-diseases/influenza/data-and-statistics https://www.webmd.com/cold-and-flu/flu-statistics



The result tab with all the probability tables is shown here + a querry on the result of ours from which we can conclude that there is a change of **0.0009** to be killed by malaria, or yellow fever or flu..etc. The best contributant to this is flu , because it affects almost all the people , while malaria and yellow fever are scarced and dependes on lot of factors to get them.


Vizita Africa
T 0.01
F 0.99
Contact cu persoane bolnave
T 0.20
F 0.80
Consum alcool/tutun
T 0.38
F 0.62
Malarie
T 0.00
F 1.00
Febra galbena
T 0.00
F 1.00
Gripa
T 0.06
F 0.94
Laringita
T 0.28
F 0.72
Stari de voma
T 0.00
F 1.00
Febra
T 0.02
F 0.98
Pneumonie
T 0.13
F 0.87
Tuse/Probleme respiratorii
T 0.29
F 0.71
Coma
T 0.00
F 1.00
Moarte
T 0.00
F 1.00
Query Results
Query Results for Variable Moarte
P (Moarte = T) = 9.0E-5
P (Moarte = F) = 0.99991
OK

Chapter 5

Implementation details (W_5)

The teaching objectives for this week are:

1. Illustrate each aspect of the reality that you have modelled in your solution.
2. To explain the relevant code from your scenario.

5.1 Start example

We will model the network by startting from an example which can be found here where is described a case for some diseases.

5.2 How we chose nodes

Nodes will be chosen by the chosen scope. We will put a diagnosis of a person who walks to a clinic and presents fever, vomiting, muscle pain, eec. We will try to determine the disease of the pacient by these. Nodes will be chosen such that it will have a bigger spectre of posibilities.

5.3 Probabilities

To calculate the probability of having fever, the logical "noisy" relationships are used. In propositional logic we can say that fever is true if and only if malaria, yellow fever or flu are true. The noisy-OR model allows for uncertainties as to the ability of each parent to cause his descendant to be true, so a person may have flu but without fever.

The model assumes that anything that inhibits a parent to produce a child's effect is independent of any inhibition by other parents to produce offspring effects: for example, any inhibit malaria to cause fever is independent of any flu inhibiting to produce fever. With these assumptions, fever has the false value if and only if all of his parents are inhibited to produce fever, and the probability is the product of inhibition probabilities q for each parent. We assume the following probability of inhibition:

```
q_gripa = p(-febra|gripa, -malarie, -febra g) = 0.6;
q_febra g = p(-febra |-gripa, malarie, febra g) = 0.1;
q_malarie  = p(-febra |gripa, malarie, -febra g) = 0.1;
Pe baza acestor informatii si ale asumptiilor noisy-OR,
```

se poate construi tabelul de probabilitati de mai sus. Regula generala este:
P(x_i | parents(X_i)) = 1 { product (given that j:X_j = true)[q_j],
unde produsul este aplicat parintilor care au valoarea true pentru randul respectiv.

p(febra|malarie) = 1 { q_malarie = 1 { 0.15 = 0.85
p(febra|febra galbena) = 1 { q_febraGalbena = 1 { 0.1 = 0.9
p(febra|malarie, febra galbena) = 1 - q_malarie,febraGalbena =
true = 1 { (0.15 * 0.1) = 0.985
p(febra|gripa) = 1 { q_gripa = 1-0.6 = 0.4
p(febra|gripa, febra galbena) = 1 { q_gripa,febraGalbena =
true = 1 { (0.6 * 0.1) = 0.94
p(febra|gripa, malarie) = 1 { q_gripa,malarie = true =
1 { (0.6 * 0.15) = 0.91
p(febra|gripa,malarie,febra galbena) = 1 { q_gripa,malarie,
febra galbena = true = 1 { (0.6*0.1*0.15) = 0.991.

In cazul laringitei, valorile sunt urmatoarele:
q_contact_persoane_bolnave = p(-laringita |
contact persoane bolnave, -consum tutun/alcool) = 0.22.
q_consum_tutun/alcool = p(-laringita | -contact cu persoane bolnave,
consum tutun/alcool) = 0.6.

p(laringita | -contact cu persoane bolnave, -consum_tutun/alcool) = 0
p(laringita | consum tutun/alcool) = 1 { q_consum_tutun/alcool=true =
1 { 0.6 = 0.4
p(laringita | contact cu persoane bolnave = 1 { q_contact_persoane_bolnave =
true = 1 { 0.22 = 0.78
p(laringita | contact cu persoane bolnave, contact cu persoane bolnave) =
1 { (0.66 * 0.22) = 0.868.

In cazul starilor de voma, valorile sunt urmatoarele:

q_malarie = p(-stari de voma | malarie, -febra galbena) = 0.34
q_febraGalbena = p(-stari de voma | -malarie, febra galbena) = 0.43

p(stari de voma | -malarie, -febra galbena) = 0
p(stari de voma | -malarie, febra galbena) = 1 { q_febraGalbena = true =

1 { 0.43 = 0.57
p(stari de voma | malarie, -febra galbena) = 1 { q_malarie=true = 1 { 0.34 = 0.66
p(stari de voma | malarie, febra galbena) = 1 { q_malarie, febraGalbena=true =
1 - (0.34 * 0.43) = 0.8538

In cazul pneumoniei, valorile sunt urmatoarele:
q_gripa = p(-pneumonie | gripa) = 0.28
p(pneumonie | -gripa) = 0.1
p(pneumonie | gripa) = 1 - q_gripa=true = 1 { 0.28 = 0.72

In cazul tuselor/problemelor respiratorii, valorile sunt urmatoarele:
q_gripa = p(-probleme respiratorii | gripa, -laringita) = 0.57
q_laringita = p(-probleme respiratorii | -gripa, laringita) = 0.04

p(probleme respiratorii| - laringita, -gripa) = 0
p(probleme respiratorii | -gripa, laringita) = 1 { q_laringita=true =
1 { 0.04 = 0.96
p(probleme respiratorii | gripa, -laringita) = 1 - q_gripa=true =
1 - 0.57 = 0.43
p(probleme respiratorii | gripa, laringita) =1 { q_gripa,laringita=true =
1 { (0.57 * 0.04) = 0.9772

In cazul comei, valorile sunt urmatoarele:
q_malarie = p(-coma|malarie) = 0.91
p(coma|malarie) = 1 { q_malarie=true   = 1 { 0.91 = 0.09
p(coma|-malarie) = 0

In case of death, probabilities are the following:
q_febraGalbena = q(-moarte | febraGalbena, -malarie, -laringita, -gripa) = 0.999992
q_malarie = q(-moarte | -febraGalbena, malarie, -laringita, -gripa) = 0.9712
q_laringita = q(-moarte | -febraGalbena, -malarie, laringita, -gripa) = 0.9999993
q_gripa = q(-moarte | -febraGalbena, -malarie, -laringita, gripa) = 0.999992

p(moarte | -febraGalbena, -malarie, -laringita, -gripa) = 0
p(moarte | febraGalbena, malarie, laringita, gripa) = 1 -q_all=true =
1 { (0.999992 * 0.9712 * 0.9999993 * 0.999992) = 0.0288
p(moarte | febraGalbena, malarie, laringita) = 1 -q_fg,malarie, laringita=true   =
1 { (0.999992 * 0.9712 * 0.9999993) = 0.0288
p(moarte | febraGalbena, malarie, gripa) = 1 -q_fg,m,g=true =
1 { (0.999992 * 0.9712 * 0.999992) = 0.028815
p(moarte | febraGalbena, malarie) = 1 -q_fg,m = 1 { (0.999992 * 0.9712) = 0.028807
p(moarte | febraGalbena, laringita, gripa) = 1 { q_fg,l,g=true   =
1 { (0.999992 * 0.9999993 * 0.999992) = 0.000008
p(moarte | febraGalbena, laringita) = 1 { q_fg,l=true   =
1 { (0.999992 * 0.9999993) = 0.000008
p(moarte | febraGalbena) = 1 { q_fg=true   =   1 { 0.999992 = 0.000008
p(moarte | malarie, laringita, gripa) = 1 -q_m,l,g=true =
1 { (0.9712 * 0.9999993 * 0.999992) = 0.02880
p(moarte | malarie, laringita) = 1 -q_m,l,g=true = 1 { (0.9712 * 0.9999993) = 0.0288
p(moarte | malarie, gripa) = 1 -q_m,g=true = 1 { (0.9712 * 0.9999992) = 0.0288
p(moarte | malarie) = 1 -q_m=true = 1 { (0.9712) = 0.0288
p(moarte | laringita, gripa) = 1 -q_l,g=true =
1 { (0.9999993 * 0.9999992) = 0.000008
p(moarte | laringita) = 1 -q_l,g=true = 1 { (0.9999993) = 0.000008

Chapter 6

Graphs and experiments (W_6)

The objectives for this week are:

1. To describe and interpret each experiment that you have performed

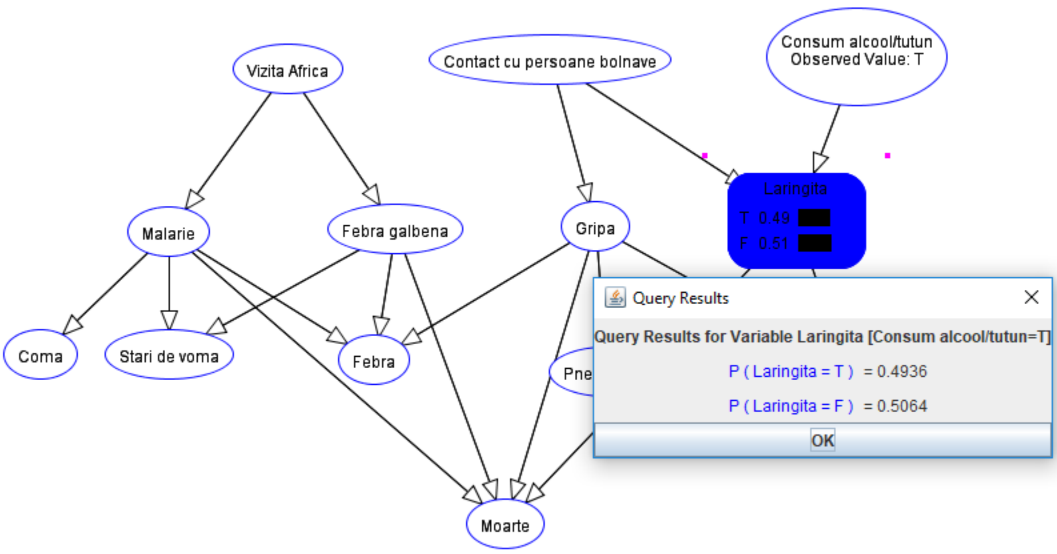
An experiment investigates how some variables are related. Usually, experiments verify a previosly formulated hypothesis. Such hypothesis may investigate how your software degrades its performance with larger inputs. You will need to run simulations to see how your implementation is affected by different inputs.

6.1 First observation

Consuming alcohol and/ or smoking with some probability of getting in contact with sick persons will have a 49 per cent chance of making laringita.

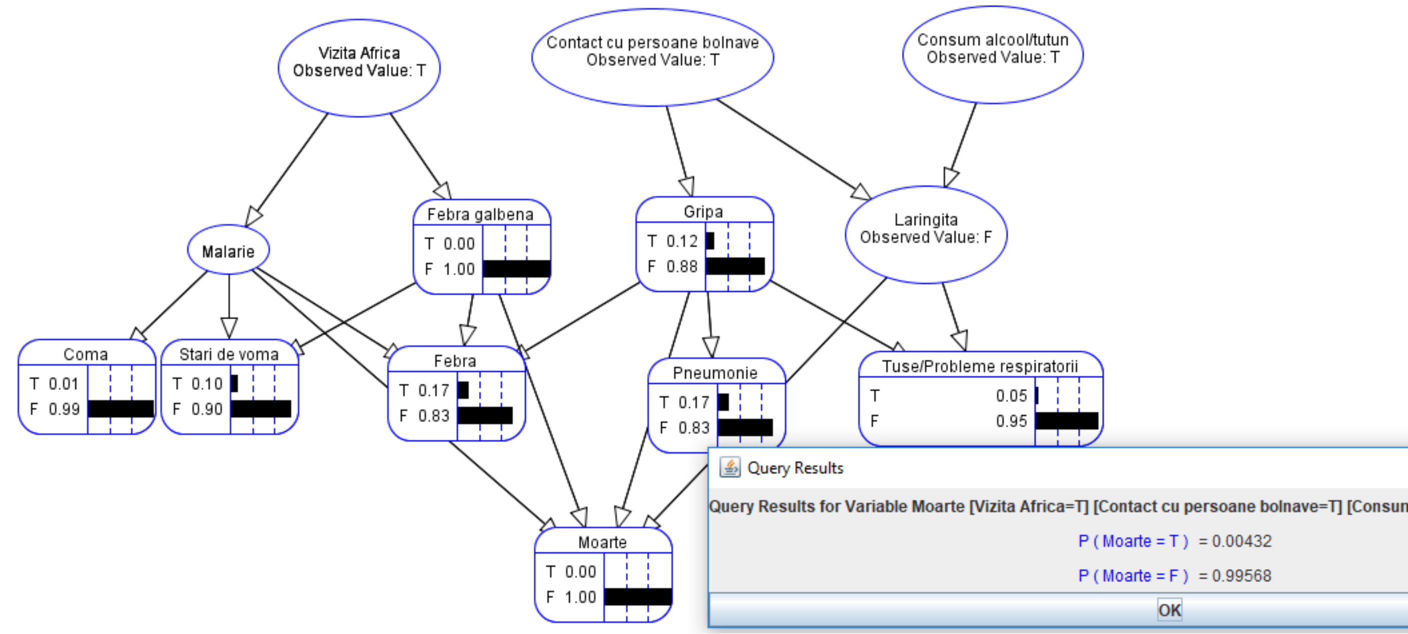
Some formulas -¿ p(L) = p(L/al,cont) * p(al) * p(cont) + p(L/al,-cont) * p(al) * p(-cont) =

= 0.86 * 1 * 0.2 + 0.4 * 1* 0.8 = 0.172 + 0.32 = 0.492



6.2 Second observation

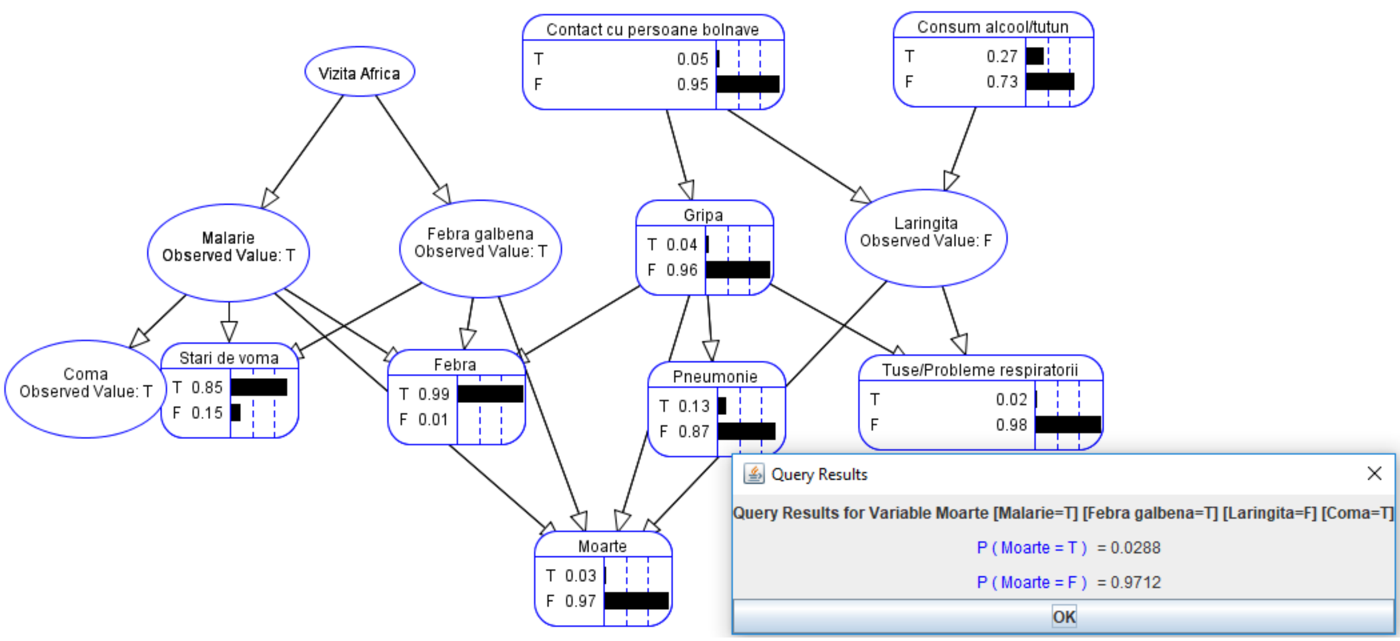
Let's assume know that the person visited Africa, had contact with sick persons and drinks and smokes.



There is a 15 pc change of getting malaria-¿ 0.01 pc of getting a coma, it is more probable 87pc to have laryngitis. But put that all aside, what is really intresting is that the death percentage rise up to 0.00446, which is somehow bad, smoking and drinking having the biggest impact here.

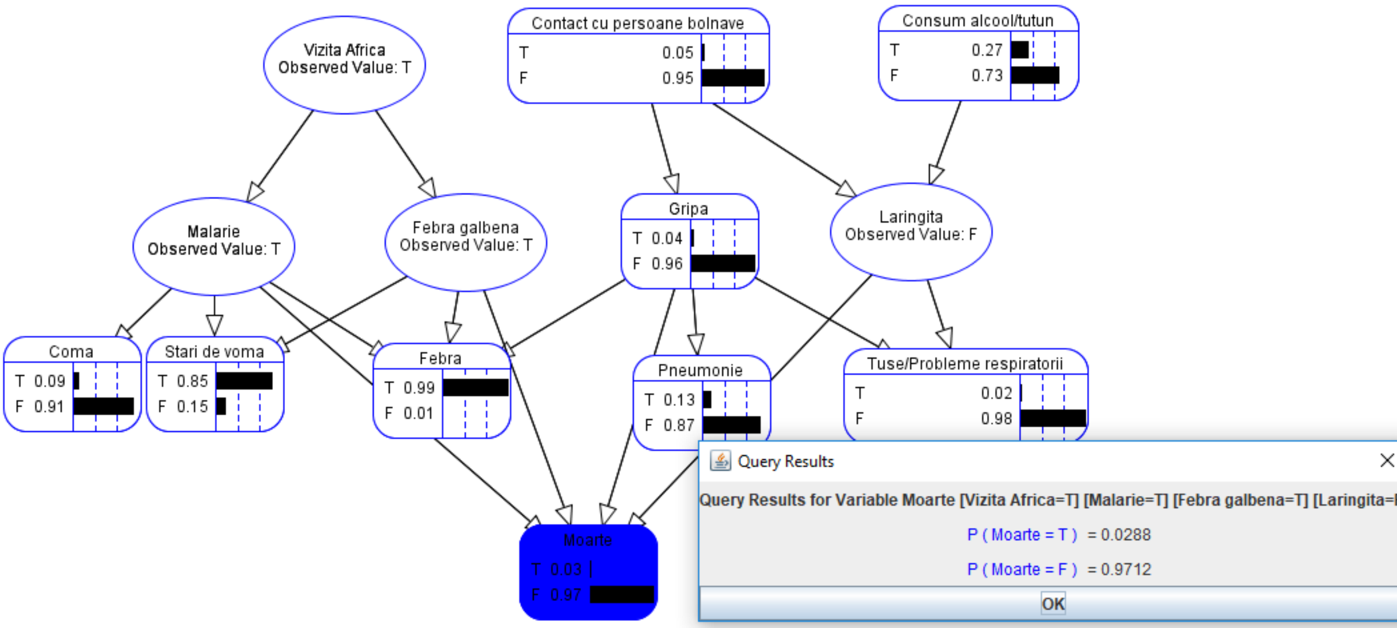
6.3 Third observation

Having malaria and yellow fever and entering a coma will bring the most likely change of getting you killed from our small percentage of statistics.. It is showing a 33pc change , which is really bad.



6.4 Fourth observation

We assume that a person visited africa, and got malaria and yellow fever, what is the probability of him having vomittings?, or fever, or coma? or even death? Let's find out with our first querry.



From here, we conclude that there is a 85pc change of having vomittings, 99 pc of having fever, and 0.09 pc of getting a coma, because is not that probable, and death only brings a 0.03 chance to the table. Not bad!.

6.5 Conclusions

This project brought a lot of searching about statistics and probabilities to the table. Me and my partner struggled to get the best available information, and filtter it. We calculated all the probabilities of the nodes by courses formulas.

We have some final results which can contribute to the helping of a real doctor. Of course our application can be improved by bringing a lot more information and staticis about our nodes, but also by making it more complex. But in it's raw stage , we can say that it can predict pretty good , based on some simptoms or first questions, what few diseases you can have , from our small pool, and what is the percentage of some serious after effects.

We can conlude saying that even if malaria and yellow fever are very dangerous and can cause massive damage to our bodies , including coma and extensive fever, the most lethal disease will remain the simple flu. Only because it is so widely spread accros all globe and dosen't have special requirements to get it.

Appendix A

Your original code

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