

## Higher Information Systems

### 2006 q.25 Expert Systems Certainty Factors

Crossandra is a type of house plant from the East Indies with green pointed leaves and spikes of bright orange flowers. Unfortunately, it is not the easiest type of house plant to look after, and a degree of expertise is required to keep a plant from one year to the next. Information about what can go wrong is shown in the following expert system rules with observed facts about a crossandra plant with appropriate certainty factors given.

a. Calculate the certainty of the conclusion that the plant is too cold.  
Show your working. **(2)**

b. Which conclusion will be drawn from the given facts? Explain your answer. **(3)**

IF rot on leaves  
THEN the conditions are too wet and humid (0.6).

IF the leaves are limp  
THEN the plant has been over watered (0.8).

IF the leaves drop AND there is no plant growth  
THEN the plant is too cold (0.8).

IF the leaves shrivel  
THEN the plant is too hot and dry (0.9).

IF the plant wilts AND  
the leaves drop  
THEN the conditions are too draughty (0.7).

The leaves are limp	0.5
The plant wilts	0.7
The leaves drop	0.9
There is no growth	0.6

## Higher Information Systems

---

### 2007 22a Expert Systems Certainty Factors

---

Dragons of Discovery is a computer game with the object of attacking dragons in order to capture their magical teeth. The user is given advice from a character called Mogo. The advice is generated by an expert system. Here are some of the rules which are used to determine the advice given.

IF dragon IS sleeping  
AND dragon can breathe fire  
AND dragon IS hungry  
THEN Advice IS Attack with magic CF 90.

IF dragon IS sleeping  
AND dragon IS hungry  
THEN Advice IS Attack with sword CF 80.

IF dragon IS sleeping  
AND dragon can breathe fire  
THEN Advice IS Attack with lance CF 70.

The following facts are known with the certainty factors given.

Dragon is sleeping 60%  
Dragon can breathe fire 80%  
Dragon is hungry 40%

- (i). Calculate the certainty of the advice "Attack with magic". Show your working. **(2)**  
What advice would Mogo give based on the rules shown? Explain your answer. **(4)**

## Higher Information Systems

### 2007P q.30 Expert Systems Certainty Factors

SPOT-OUT is an expert system that provides users with advice about stain removal. SPOT-OUT is a rule based expert system that makes use of certainty factors.

a. Give two uses made of certainty factors in an expert system. **(2)**

b. The rule shown below is included in the SPOT-OUT expert system:

**ADVICE Spray with hair-spray and wash as normal (80%)**

**IF Stain is due to ink**

**AND Stain is on fabric.**

Haymon uses the expert system to get advice about how to deal with an ink stain on his shirt.

He provides the expert system with the information below:

Calculate the certainty of the conclusion:

**Spray with hair-spray and wash as normal.**

You should show all working. **(2)**

Users of the SPOT-OUT expert system can ask for justification of any advice that is suggested.

Explain how the expert system would justify any advice that it suggests. **(2)**

The stain is due to ink:

**Certainty Factor:** 50%  60%  70%  80%  90%  100%

The stain is due to grease:

**Certainty Factor:** 50%  60%  70%  80%  90%  100%

The stain is on fabric:

**Certainty Factor:** 50%  60%  70%  80%  90%  100%

The stain is on upholstery:

**Certainty Factor:** 50%  60%  70%  80%  90%  100%

## Higher Information Systems

---

### 2008 25 Expert Systems Certainty Factors

---

PHYSIO-24 is an expert system designed to diagnose sports injuries. Symptoms of the injury are requested from the user. The input is evaluated through a set of rules with certainty factors. A simplified sample of rules for an injured foot is shown below.

IF pain is on ball of foot  
AND bending toes is painful  
THEN patient suffers from loss of padding on sole (0.7)

IF pain is on heel  
AND bending toes is painful  
THEN patient has heel spur (0.7)

IF pain is on heel  
AND pain is up leg  
THEN patient is suffering from damaged Achilles tendon (0.9)

The following facts are known with certainty factors given:

The pain is on ball of foot	0.5
Bending toes is painful	0.8
Pain is up leg	0.5
Pain is on heel	0.8

(i). Calculate the certainty of the conclusion that the patient is suffering from loss of padding on sole. Show your working. **(2)**

(ii) Identify the conclusion drawn from the given facts. Explain your answer. **(4)**

b. "Severe pain and swelling on the ankle indicate that it is very likely that the ankle is broken."

The following rule is added to the expert system to represent the knowledge above:

IF pain is on ankle  
AND swelling is yes  
THEN patient is suffering from a broken ankle

State a certainty factor for this rule and explain your answer. **(2)**

†

---

### 2008P q.26c Expert Systems Certainty Factors

---

Tom is interested in sailing and has decided to make an expert system regarding pleasure boats.

Certainty factors are often features of expert systems.

(i). Describe **two** benefits that can be claimed for an expert system that implements certainty factors. **(2)**

(ii). Give **two** reasons why some expert systems do not use certainty factors. **(2)**

## Higher Information Systems

---

### 2009 28ai Expert Systems Certainty Factors

---

Professor Slessor is exploring in the mountains of Crossandra. He has discovered a sack of ancient Crossandran coins. Ancient Crossandran coins:

- were made of silver or pewter, which looks very much like silver;
- had pictures of transport methods on one side;
- were inscribed with the emperor's name on the other side.

Using an expert system on his laptop the professor is trying to identify the coins. Here are some of the rules from the expert system which are used to determine the type of coin:

IF metal IS silver  
AND picture IS ship  
AND inscription IS "Kraax"  
THEN coin IS crown CF 90.

IF metal IS silver  
AND picture IS ship  
THEN coin IS coronet CF 70.

IF metal IS silver  
AND inscription IS "Kraax"  
THEN coin IS helm CF 80.

After examining one of the coins Professor Slessor decides the following facts with the certainty factors given.

The coin is made of silver 80%

The picture is a ship 60%

The inscription is Kraax 40%

Calculate the certainty of the coin being identified as a crown. Show your working.

---

### 2009 28aii Expert Systems Certainty Factors

---

Based on the rules and facts above, which type of coin would the expert system conclude Professor Slessor is examining. Explain your answer.

## Higher Information Systems

---

### 2009P q.22a Expert Systems Certainty Factors

---

Northania is an island which is a popular destination for scuba divers. Around the coast there are many dive sites, each offering divers a particular attraction. One of the local dive companies has developed an expert system to try to ensure that divers get those dives which they would most enjoy.

Information about some of the dive sites is shown below as expert system rules.

A diver was asked about her preferences for dives and gave answers with the following certainty factors:

**like to visit a wreck 0.5**

**like to see sting rays 0.7**

**like to see black coral 0.9**

**like to do a deep dive 0.6**

a. (i). Calculate the certainty of the conclusion that the diver would enjoy Antonio's Canyon. **(2)**

(ii). Which conclusion will be reached for the given facts? Explain your answer. **(4)**

(iii). When asked, a diver said that he would very much like to carry out a drift dive. State a suitable certainty factor which could be allocated to this answer. **(1)**

IF you want to see sharks  
THEN you will enjoy Big Tooth Bay (0.6)

IF you want to visit a wreck  
THEN you will enjoy Poseidon Dive (0.8)

IF you want to see black coral AND  
you would like a deep dive  
THEN you will enjoy Antonio's Canyon (0.8)

IF you would like to drift with the current  
THEN you will enjoy Long Reef (0.9)

IF you would like to see sting rays AND  
you would like to see black coral  
THEN you will enjoy Ray City (0.7)