Universitetet i Stavanger

KANDIDAT

8730

PRØVE

RIS505 1 Grunnleggende temaer innen risikostyring og risikovitenskap

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RIS505

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1 Problem 1

Lisa is a student. She likes traveling and she plans a 1-month trip around the world. She thinks about risk and performs a risk assessment. Her traveling is carefully planned.

Are these statements correct according to risk science (curriculum)?

   a. Lisa faces risks as there is a potential for undesirable events/consequences
   b. Lisa considers the travel safe by reference to a low judged probability of undesirable events/consequences, supported by rather strong knowledge
   c. Lisa is a resilient person, and that contributes to make the risk low.

Please answer yes and no - comments can be made to explain and support your answer (to obtain full score it is sufficient to answer yes/no)

Fill in your answer here

a) yes

b) yes

c) no

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode:

5 8 8 1 3 5

2 Problem 2

It is common to characterize risk by risk matrices, where the assessor specifies one probability and one consequence category for each event assessed.

What are the two main problems with this approach? Explain how you can improve the risk characterizations by fixing the consequence dimension.

Fill in your answer here

1) Two event can be given the same potition in the risk matrix but the two can have have different knowledge supporting it and strength of this knowledge. When using risk matrices it can therefore give a false safety when looking at the probabilities and consequences.

2) The other problem with this matrix is that its based on the much used definition of risk as: probability X consequense. This definition is computing an expected value which dosent reflect well on uncertainties and risk, dosent add the potential of extreme outcomes, and the knowledge supporting the probabilities is not added nor the strength of this knowledge.

We can improve the risk characterizations by for example add other dimentions adding the knowledge supporting the consequences and the strength of this knowledge. This will help separating different activities from each other so they dont be viewed as the same.

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode: **5 8 2 1 4 7 3**

³ Problem 3

Probability is used to represent/express variation and uncertainty. Explain what this means. Give an interpretation of an imprecise knowledge-based probability " less than or equal to 0.10".

Define a black swan event. There are different types of black swans. The events on September 11 2001 can be viewed as being of two types – what are these two types?

Fill in your answer here

This means that probability is used to provide a better picture of the risk we face so we can define an meaningful interpretation of how likely it is that an event A will occur or the likelyhood of different consequences C given the activity A. This can be done with using both frequentist and knowledge-based (subjective) probabilities.

P(A/K) less or equal to 0.10 : the assessor has the same uncertainty and degree of belief as randomly drawing a red ball out of an urn containing 100 balls where 10 or less balls are red. The assessor is not willing to be more precise.

A black swan can be seen as an extreme, surprising event relative to one´s knowledge. The 9/11 attack can first be classified as a black swan of the unkown known type because the attack was unknown to happen by the ones doin the risk assessment, but known by others, in this case known by the terrorists. It can also be classified as a black swan of the type known known which is an event that is on the list of possible event in risk assessments, but due to very low probability, the event is believed not to occur. Terrorism is happening all over the world every year so it is known that these types of actions can be made. Therefore the risk assessment team would know that terrorism could happend, but since it was highly unlikely it still came as a surprise.

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode:

4 8 8 3 5 0 4

⁴ Problem 4

Draw a fault tree with two basic events 1 and 2, linked to the top event by an AND gate. Draw also the corresponding reliability block diagram.

Suppose the basic events occur with probability 0.01 each, and that these events are independent.

Compute the probability of the top event. Specify the minimal cut set(s).

Fill in your answer here

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode:

7 1 1 9 2 2

Question Code Oppgavekode	Date Dato	Subject code Emnekode	Candidate ID KandidatID	Question nr Oppgavenr	Page number Sidetall
7111922	2/12/22	RIS 505	8730	4	1

Drawing area Tegneområde

fault tree

Top evat

Evat 1

Evat 2

Block diagram

1

2
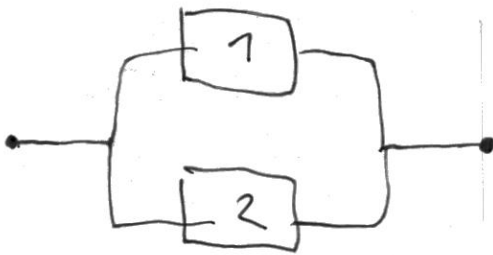
minimal Cut set : $(1,2)$

$$0,01 \cdot 0,01 \approx 0,0001$$

⁵ Problem 5

Resilience is an important aspect of risk management. Why is it so important?   Explain why it is so difficult to measure the degree of resilience.

Fill in your answer here

Resilience is the a systems abaility to restore or sustain its basic functionality following an event (risk source).

Resilience is an important aspect of risk management because it does not require an accurate risk assessment to increase the resilience. Take an example of were you eat healthy, exercise and sleep enough, you would increase your resilience for threats both of the known but also the unknown type. This can be the case for risk management cases as well. We can increase the resilience when we dont know what threats we willl meet. But it also is a difficult aspect of it as the cost and benefits need to be managed, and this is difficult when we dont know what events to prepare for and if they even will occur or when they will occur. It will therefor be a political and managerial issue to spend a lot of money on some measures to increse the resilience when we dont know if it will be usefull or not. Take the example with the numbers of ventilators during the pandemic, it is easy in hinsight to say that there should have been more ventilators available but it would have been very expensive to have an excessive number of ventilators stored away that is not needed in everyday situations. Costs and benefits therefore need to be balanced.

The measurement of resilience is difficult as we can be exposed to all sorts of threats, events, hazards and these events can be, even if we can increase the overall resilience in some aspectys e.g, a society without knowing what event that will occur, we cant measure exact how resilient our society is as we cant predict the future and what events it will bring.

Take the human body, we can be resilient to some sort of things, like bruises, breaking legs, getting the flue, but there are still other sources that our body is not resilience against on its own, without medication and antibiotics like the HIV virus that in time will develop and turn into AIDS if you dont get the right

treatment. So we cant say that the the human body is measured as high resilient, because it depends on the risk source.

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode:

0 6 7 7 6 3 9

6 **Problem 6**

A risk reducing measure has an ICAF equal to 50 mill euros. A VSL equal to 30 mill euros is specified.

How can this information be used to determine whether the measure should be implemented or not. Explain. Discuss to what extent the decision should be based on considerations of ICAF and VSL only.

Fill in your answer here

VSL: value of a statistical life (The maximium value one is willing to pay to reduce the expected number of fatalities by 1).

ICAF: implied cost of averting a fatality (how much it is expected to cost to save an expected life)

If ICAF > VSL the measure is not justified as is shows that a measure will cost more than what the decision-maker is willing to pay. If ICAF < VSL the measure should be implemented as the expected cost is lower than what the decision-maker is willing to pay.

If the ICAF is bigger than the VSL, the safety measure should still be concidered if it were to be given weight to the ALARP principle that the risk level should be as low as reasonably practicable. This means that a measure that can improve safety should be implemented as a rule unless it can be demonstrated that the costs are grossly disproportionate to the benefits gained, one can refrain from implementing the measure, this represents a reversed burden of proof and means that protection is highlighted. In this case the ICAF exceeds the VSL by 20 millions, I would argue that the measure still shold be concidered implemented if it were to support a cautionary thinking.

Decisions should not be solely based on ICAF and VSL since expected values are used to compute these (In cost-effectivness and cost-benefit analysis), expected values dont reflect well on risk and uncertainties, the knowledge behind the numbers nor the strenght of this knowledge. It also do not express the potential for extreme outcomes.

⁷ Problem 7

Define the precautionary principle. Explain how the principle was used in relation to the coronavirus pandemic in March 2020. Is the principle in conflict with science? Explain.

Fill in your answer here

If the consequences of an activity could be serious and subject of scientific uncertainty, precautionary measures should be taken or the activity should not be carried out. This principle is made to protect values like life, health and the environment when uncertainties are large and consequences can be severe. This is a reversed burden of proof, there is a red light that can only be switched to green if there is proof that the there is not scientific uncertainty and serious consequences.

The precautionary principle was giving weight to in march 2020 when the norwegian government decided to shut down the society, since the consequences could be serious, the uncertainties where substantial and science did not have the answers, the government could not sit around and wait for science to provide answers, something had to be done right now to avoid potential negative consequences. the society decided to take precautionary measures and shut down the society including activities like sports, resurants and even schools were restricted to online education. It is not in conflict with science as science does not have clear answers and we cant wait to recieve answers before taking action.

⁸ Problem 8

Risk perception is not the same as professional risk judgments. What are the main differences?

A person perceives the risk concerning a relatively new type of medical treatment to be large, despite the experts expressing that the treatment is safe. Is the person necessarily wrong? Explain.

Fill in your answer here

a) Professional risk judgements provide "pure" risk characterizations and judgements like in the (A´, C´, Q, K) without taking feelings or value judgements on how people like or dislike the risk into the assessment.

Risk perception on the other hand is a persons judgement or appraisal of risk that include these aspects. Factors like familiarity, control, affect and catastrophic potential are important for how people understand and deal with risk. The pshychonmetric paradigm illustrates which activities/factors people fear the most with using the two aspects dread and newness, here is for example nuclear power placed in the top right corner, it is both relatively new and the consequences could be catastropic. The newness and dread categories derives from the 4 chategories:Control, delays in effect, new and unkown and catastrophic potential. For example people feel more safe when driving their own car rather than beeing the passenger on an airplane, even though it is concidered much more safe to travel with an airplane rather than with a car, this highlights the conrol aspect where you feel that the risk is lower because you is controlling the vehicle.

The professional risk judgement is to a large extent based on system 2 thinking which is caracterized by slow, logical and deliberate thinking. Risk perception is mostly based on system 1 thinking with is quick/ instinctively and automatic and emotional.

b) Risk perception may capture some important aspect that was not taking into accound by the professionals. As the new type of medical treatment is new, we look into the future and there will therefore be uncertainties, there is no true reference and therefore both the event and uncertainties are unkown by

everyone. The person is not necessarily wrong and can add some important insights to how the risk should be judged.

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode:

3 3 3 3 7 2 7

⁹ Problem 9

A main goal of risk communication is to improve people's risk understanding. In relation to covid-19, governments officials in a country communicated Dec 2021 that "…For the unvaccinated, you're looking at a winter of severe illness and death for yourselves, your families, and the hospitals you may soon overwhelm."

How would you characterize this statement in relation to the goal of informing people about the risks? What do you think is the underlying motivation for the statement? How would you judge the message from a risk science perspective?

Fill in your answer here

This can be seen in to ways because risk communication has different goals and targets for the information. This definetly covers the goal of inform people on the risk, but maybe not the goal of behavioural change which the message is seeking to accieve as the underlying motivation for this statement is to get people to take the vaccine as this would help society return to a normal state much faster and potentially reduce the number of fatalities.

Risk science is the most updated and justified knowledge on basic concepts, assessment, perception and commiunication and management and governance, and it is also the process and practise than provides this knowlede. As risk science seek to make people understand riks so better judgements and decisions can be made, this is not a good message. The message does not present the knowledge that the statement is based on nor the strength of this knowledge and it will therefor be difficult to make people want to change behaviour as people dont get more information about the underlying factors of the statement presented. As risk communication seek to create an understanding of the risks concidered so people better can make informed judgements, this statemenst does not fullfill that as is only express a limited degree of the information available of the topic.

Knytte håndtegninger til denne oppgaven?
Bruk følgende kode:

9 4 7 2 3 7 2

¹⁰ Problem 10

Explain what risk science means.

Why cannot knowledge be interpreted as justified *true* beliefs in a risk science context.

In a specific risk assessment, risk is characterized by (C',P,SoK,K), using the terminology from the curriculum. Is it possible to argue that (C',P,SoK,K) expresses the analysts' knowledge? Explain.

Give an example how generic risk science can help or support climate change risk research and studies.

Fill in your answer here

a) Risk science is the most updated and justified knowledge on basic concepts, assessment, perception and commiunication and management and governance, and it is also the process and practise than provides this knowlede.

b)We can have some justified beliefs about C, the consequences of the activity concidered, but as C is not known today there are uncertainty, hence knowledge cannot be restricted to justified TRUE beliefs.

c) As P and SoK is measurements of the uncertainties and consequences C´, it can be expressed as the analyst knowledge. when for example assigmning different probabilities P to an event like "Venezia will be under water by 2050" this statement is knowledge K based on the assessors judgement of uncertainty. The SoK in the description is strength of knowledge justments that can be added to adress weather the knowledge K is strong, medium or weak. We can use certain criteria to adress this like the reasonality of assuption, relevant data/information available, the level of agreement of experts, to which the degree knowledge K has been thoruohly examined and if the phenomena is well understood and models exist.

d) Genereic risk covers scientific knowledge related to the development of risk concepts, models, methods, principles and approaches on how to understand, assess, characterize, communicate, manage and govern risk (type B science) . Generic risk science supports applied risk science (type A science) by offering improved concepts, models, methods, principles and approaches for practical

use. In the case of climate change the work is mostly done by other sciences (typically natural sciencies) with risk science as as a contributor on how to characterize the risk.

e) A paper on how to best characterize risk is a contribution to generic risk science but the information in this paper can be used for specific activities like climate change.

Knytte håndtegninger til denne oppgaven?
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5 9 3 4 6 4 4