

Final Exam - Extra Time

Due 18 Jun 2020 at 10:55 **Points** 20 **Questions** 21
Available until 18 Jun 2020 at 10:55 **Time limit** 115 Minutes

Instructions

The exam consists of 20 multiple choice questions you have to answer one by one. This means you only see one question at a time and you cannot revise your answer after submitting it.

You may use your notes while taking the exam but you must work on your own. Do not share your answers or discuss with anyone, even after completing the test.

You will have 115 minutes to complete the exam up until the deadline at 10:55 AM. The quiz function in Canvas will automatically stop at 10:55 AM regardless of how much time the timer says because that is the final deadline.

If you have any questions for clarification of need any other assistance you can reach the teacher via the Canvas Conference.

Good luck!

This quiz was locked 18 Jun 2020 at 10:55.

Attempt history

	Attempt	Time	Score
LATEST	Attempt 1	106 minutes	16 out of 20

❗ Correct answers are no longer available.

Score for this quiz: **16** out of 20

Submitted 18 Jun 2020 at 10:47

This attempt took 106 minutes.

Question 1

0 / 0 pts

I agree to take this exam in a manner that is consistent with the rules for online examination of the University of Twente and this course.

I affirm that I will not give or receive any unauthorized help on this exam, and that all work will be my own.

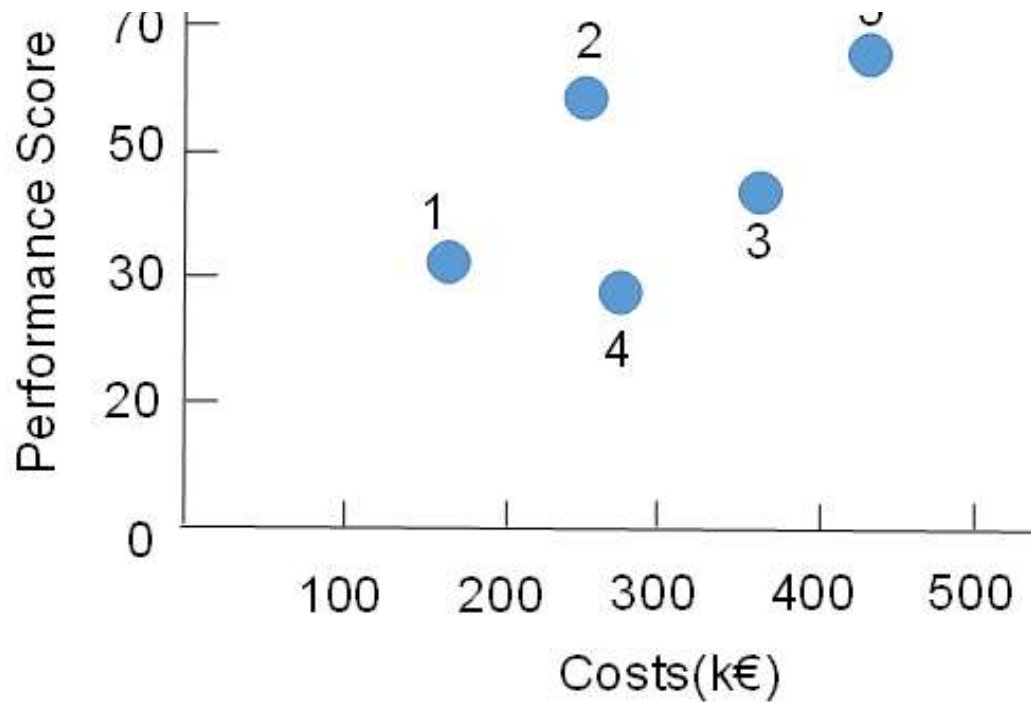
☒ True

☐ False

Question 2

1 / 1 pts

An infrastructure manager needs to decide on the intervention strategy for a road link. She identified five strategies and determined for each strategy a performance score. The performance score is an aggregate score including the evaluation of different performance criteria such as safety, availability, and reliability. In addition, the infrastructure manager calculated the costs of each strategy. She put performance scores and costs of the strategies in a diagram shown below.



Based on this diagram which intervention strategy should the infrastructure manager select?

- ☒ Strategy 1, strategy 2 or strategy 5
- ☐ Strategy 1 or strategy 4
- ☐ None of the strategies
- ☐ Strategy 5

Incorrect

Question 3

0 / 1 pts

After several decades of service, a railway bridge is up for replacement. The estimated service life of the new bridge is 60 years. The replacement cost is €600.000,-. During its replacement cycle, the bridge will require two rehabilitation

events in year 20 and in year 40 each costing €200.000,-. The average annual cost of maintenance is €5.000,-. At the end of the replacement cycle, the bridge will again be replaced and the entire cycle is assumed to recur to perpetuity. What is the present worth of all agency costs in perpetuity? Assume an interest rate of 5%.

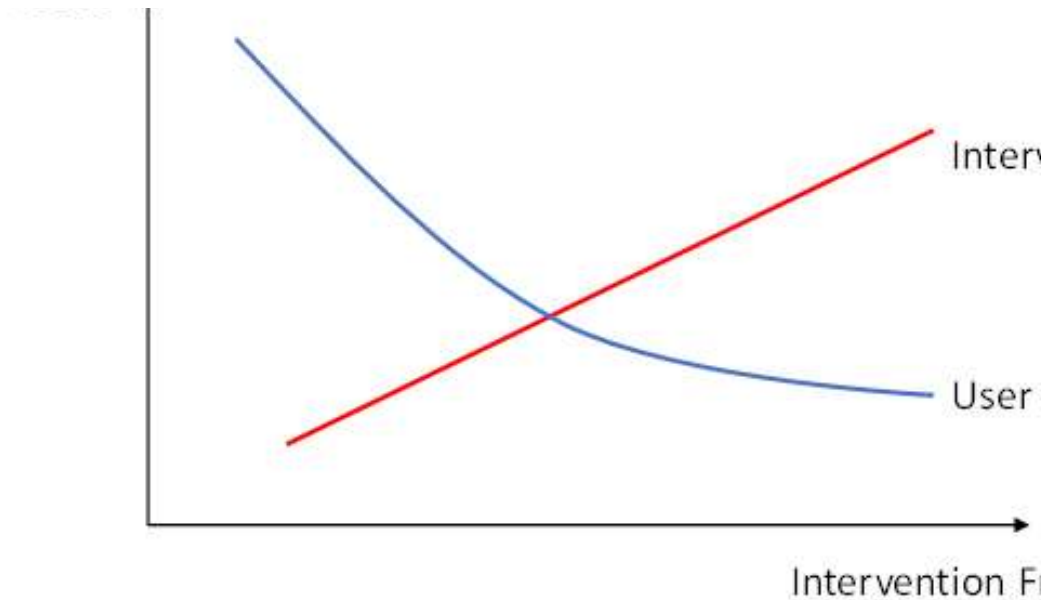
- ☐ €843.596,-.
- ☒ €14.760.321,-.
- ☐ €14.914.087,-.
- ☐ €856.909,-.

Question 4

1 / 1 pts

In a team meeting of a road agency a heated discussion about the required interventions to be applied in the upcoming period emerged. Some team members had the opinion that as many as possible interventions should be executed to bring the performance of the infrastructure assets back to the required performance level. Other team members thought that intervention costs should be minimized since the budget of the province is very limited. In order to support the discussion one infrastructure manager presented the figure shown below.

Costs ▲



What does this figure show?



It shows that the user costs should outweigh the intervention costs and the sum of both should be minimized.



It shows that as many as possible interventions should be executed to improve the performance of the assets and thus to decrease the user costs.



It shows that the intervention frequency is more important than the total number of interventions. The frequency needs to be minimized to get the lowest intervention costs.



It shows that intervention costs should be minimized since the user costs do not decrease further at a certain point in time.

Question 5**1 / 1 pts**

For executing the interventions on a road network link the infrastructure managers of an agency wants to contract a service provider. The work to be done on the road link mainly includes the repair of small road damages, the replacement of damaged road equipment, the mowing of grass, the cutting of trees, the cleaning of the road drainage, the cleaning of road signs, the removing of graffiti from objects, and the cleaning out of litter bins on parking areas. These services were already bought from other service providers in previous years. However, the infrastructure manager was not very satisfied with the delivered services. He now wants to integrate all services in one contract and make one contractor responsible for the required work over a duration of 5 years. When putting such a contract on the market the following effect on roles and responsibilities can be expected:



The contractor assumes more responsibilities as service provider but there are no further changes in his role.



The contractor takes on the role of the asset manager for road network, since he has the single responsibility for the work to be executed.



The contractor is still in the role of the service provider but shares the asset management role with the agency, since he has to coordinate and plan the work he is responsible for.



The contractor is now in the role of the asset owner, since he needs to adopt a more long-term and strategic thinking that requires a more holistic view on the road network.

Question 6

1 / 1 pts

Road agencies have the opportunity to restrict the load for bridges if they believe the bridges are not able to bear all traffic loads. They can install traffic signs like the one on the picture below. These signs inform road users whether they are allowed to pass the bridge with their vehicles.



Source: Daily Express

Restricting the traffic load of bridges means:



- ☒ the service life of the bridges has terminated.

- ☐ more detailed inspections are required.
- ☐ the bridges need to be replaced.
- ☐ the bridges have lost their functionality.

Incorrect**Question 7****0 / 1 pts**

A railway agency decides to use life-cycle cost analysis for identifying intervention strategies. The agency believes that based on this approach postponing interventions becomes more attractive. As an infrastructure manager states: "The further in the future interventions are the lower the present worth of costs, so it is beneficial for the agency to postpone interventions".

Do you agree with the statement of the infrastructure manager?

☐

Yes, it is always more beneficial the further away in the future costs are incurred.

☐

No, because it does not matter when interventions are applied.

☐

No, postponing interventions often requires more work in the future and thus more costs.

☒

No, there are also costs for the railway users due to infrastructure in poor condition.

Question 8**1 / 1 pts**

An employee of a road agency suggests to consider the relative importance of three criteria for prioritizing interventions: safety, comfort and travel time. She believes that road users evaluate the importance of performance criteria relative to each other. She presents a figure showing the three criteria based on explicit and implicit (relative) importance. Implicit importance is derived by correlating criteria importance and overall satisfaction of the road users.



Which of the following conclusions is in line with this figure?



Safety has a high explicit and implicit importance. This suggests that the satisfaction of road users will drastically drop if the criterion is below a certain performance level. The agency should definitely pay attention here. The agency should not pay much attention to comfort, since road users are satisfied in this area. Travel time also does not need much attention at the moment. The satisfaction of road user will not increase if travel time is improved.



Safety should be given attention, since it is very important for road users. Comfort is not very important for road user and thus no effort is needed here. Travel time is slightly important for road users and no further attention should be paid to this criterion.



Because of the high explicit but low implicit importance of travel time, the agency should pay attention to this criterion to keep the overall satisfaction of road users. Somewhat more attention should be paid to comfort, since the implicit importance is high while the explicit importance is low. The overall satisfaction of the road users can be increased. Safety shows a high explicit and implicit performance and the agency may decide to pay less attention to this criterion at the moment.



Safety should be kept on this level, in order to keep the overall satisfaction of the road users. Comfort should receive more attention, because road users will be more satisfied. Travel time does not need much attention, since the overall satisfaction of the road users is not much related to this criterion.

Incorrect**Question 9****0 / 1 pts**

An intervention strategy an infrastructure manager wants to apply for a road network link does not change the function of the road assets. In other words, the assets will provide the same services after the interventions. In order to determine the benefits of applying the intervention strategy, the infrastructure manager needs to:

- ☐ Determine at least two interventions for a road asset.
- ☐ Include technical and non-technical interventions in the strategy.
- ☐ Compare the costs of at least two intervention strategies.
- ☒ Compare agency and user costs for the analysis period.

Incorrect

Question 10

0 / 1 pts

An infrastructure manager from a road agency wants to determine the optimal intervention strategy for the road network link for the next 30 years by calculating the costs incurred by different interventions applied in the 30 years period. The manager uses the present-worth-cost method and calculates agency and user costs. The calculation will show that the earlier the interventions are planned:

- ☐ The greater agency and user costs.

- ☐ The greater agency costs and the lower user costs.
- ☒ The lower agency and user costs.
- ☐ The lower agency costs and the greater user costs.

Question 11**1 / 1 pts**

In stakeholder satisfaction surveys a performance characteristic of an asset can be called basic factor if:

- ☐ the overall satisfaction of stakeholders is quickly increasing when the importance of the performance characteristic is also increasing.
- ☒ the overall satisfaction of stakeholders is quickly decreasing when the expectation about the performance characteristic is not fulfilled.
- ☐ the overall satisfaction of stakeholders is steadily decreasing when the importance of the performance characteristic is also decreasing.
- ☐ the overall satisfaction of stakeholders is steadily increasing when the expectation about the performance characteristic is exceeded.

Question 12**1 / 1 pts**

An agency seeks to identify the more cost-effective material to replace an aging guardrail for a long stretch of highway. Design alternative A has initial project costs of €200.000,-, annual maintenance and operation costs of €80.000,-, a salvage value of €22.000,- and annual benefits of €750.000,- in terms of fatalities avoided. The estimated life of this alternative is 7 years. Design alternative B has initial costs of €175.000,-, annual maintenance and operation costs of €90.000,-, a salvage value of €15.000,- and annual benefits of €750.000,-. The estimated life of this alternative is 7 years. Which method is most appropriate and should be chosen by the agency for the comparison of the two design alternatives?

- ☐ Equivalent Uniform Annual Return method.
- ☒ Present-Worth-Cost method.
- ☐ Net Present Value method.
- ☐ Equivalent Uniform Annual Cost method.

Question 13**1 / 1 pts**

A typical characteristic of infrastructure is that only one party is providing the infrastructure network and asset because there are very high capital costs involved in setting up these networks. In most case there is also not the possibility to build another network just beside the existing one.

What is this characteristic of infrastructure called?

- ☒ Natural monopoly
- ☐ Fixed capital asset
- ☐ Network characteristic
- ☐ Tangible object

Question 14

1 / 1 pts

In its annual report a road agency relates the achieved performance of its road network to the initially formulated objectives for the network. The agency asks you to critically reflect on their achieved performance. Below one of these objectives and the reported performance are shown.

Objective

Performance Reported

Improving the availability of the highway network

The performance in the area of transport supply has once again been outstanding performance measures indicate that the are well-served and the financial results I continue gains in efficiency. The average maintenance costs spent for 1 km being compared with the planning of €2700,-.

What feedback would you give to the agency?

◀ ▶



The reported performance clearly shows that the agency could achieve its objective.



The objective is in conflict with the performance reported.



The reported performance is not in related to the objective.



The reported performance actually constraints the achievement of the objective.

Question 15

1 / 1 pts

The management team plans to implement the infrastructure management process in the road agency. This includes the decision about the allocation of task and responsibilities to the different departments. The management team asks an internal advice group to come up with a process description for the agency. Since the advice group consists of employees from the different departments, the group cannot deliver a common process description. The 4 members of the group are particularly indifferent about the general starting point of the process.

Jan: We first need to have a good picture of the performance of our asset. So, we should start with inspecting them and based on that we should define what are main risks of failure. We then can define possible measures to deal with these risks. After this, a new inspection interval is starting.

Monique: From my perspective, we should start with a good understanding of the infrastructure stakeholders and their needs. Based on these needs, we can define objectives for our infrastructure assets and then we can continue with identifying asset performance.

Herbert: The budget should be always the starting point. It will define what you can do with your assets. At the beginning, we should formulate the infrastructure objectives based on the available budget. It does not make sense to formulate objectives that cannot be realized because of a non-available budget.

Bea: Of course, the budget is important, but first of all we should identify the assets that are critical for the stakeholders. We then can formulate the objectives to allow these assets to provide their services to the stakeholders.

With whom do you agree about the general starting point of the asset management process?

☐ Jan

☒ Monique

☐ Bea

☐ Herbert

Question 16

1 / 1 pts

For the replacement of road lighting an infrastructure manager has identified two alternatives. Alternative A has initial costs of

€10.000,-, annual maintenance and operating costs of €800,-, and €2.000,- salvage value. Alternative B has initial costs of €7.500,-, annual maintenance and operating costs of €1.200,- and €1.000,- salvage value. The estimated remaining lives of alternative A and B are 16 and 12 years, respectively. Which alternative should the infrastructure manager select? Assume an interest rate of 6%.

☐ Alternative B should be selected.

☒ Alternative A should be selected.

☐

From a cost perspective, both alternatives could be selected.

☐ None of the alternatives should be selected.

Question 17

1 / 1 pts

An infrastructure manager of the railway agency wants to select an intervention for the replacement of switches. He identified four interventions and intends to evaluate these interventions on four criteria: intervention costs, work emissions, possession time, and environmental impact (see below). He knows that for the railway agency, possession time (0.4) has the highest priority followed by intervention costs (0.3), environmental impact (0.2) and work emissions (0.1).

Intervention costs (€)	Possession time (hrs)	Work emissions (dB)
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Intervention 1	320.000,-	6	55
Intervention 2	340.000,-	8	55
Intervention 3	340.000,-	5	50
Intervention 4	290.000,-	8	50

Which intervention(s) should the infrastructure manager evaluate?

◀ [REDACTED] ▶

- ☐ Interventions 2, 3 and 4.
- ☐ All interventions.
- ☐ Interventions 1, 2 and 3.
- ☒ Interventions 1, 3 and 4.

Question 18

1 / 1 pts

In order to allow the comparison of strategic alternatives based on different criteria with different dimensions, the following task is required:

☐ Calculating the priority vector.

☐ Establishing relative importance of criteria.

☐ Quantifying the level of each criterion for each alternative.

☒ Establishing commensurate scale for measuring levels of each criterion.

Question 19

1 / 1 pts

A railway agency is responsible for the management of a wider railway network consisting of several assets including switches, catenary, signals and electrical installations. In recent years the number of switch failures has increased which often led to a decrease of track availability. The infrastructure manager of the railway agency decides to investigate the problem further. He discovers that particularly after cold nights with snowfall the tongues of the switches could not be moved due to ice and snow. When further looking into the switch components, he detects that many switch heating systems do not provide enough heating capacity to melt ice and snow. The reason is that the technical specification used by the agency for the switch heating system does not consider the combination of ice and snow. Based on the infrastructure manager's level of analysis the loss of the ability of a switch to move its tongues during cold nights with snowfall is a:

☒ Failure effect

- ☐ Failure mode
- ☐ Failure cause
- ☐ Failure mechanism

Question 20**1 / 1 pts**

The government let a new law which limits the noise level emitted by road asphalt in inner cities. Every road asphalt that cannot comply with the new requirement is:

- ☒ At the end of its service life.
- ☐ At the end of its operational time.
- ☐ At the end of its economic life.
- ☐ At the end of its life-cycle.

Question 21**1 / 1 pts**

Due to a changed train schedule, the railway agency has to reduce the possession time available for railway interventions from 6hrs to 5hrs. The infrastructure manager of the railway agency is asked to reconsider the planned intervention strategy for 3 components of one of the railway lines (see Figure 1). He knows the individual intervention cost – c_i , the service-life

shortening cost – c_s , the intervention time – t_m , and the possession cost – c_p (Table 1).

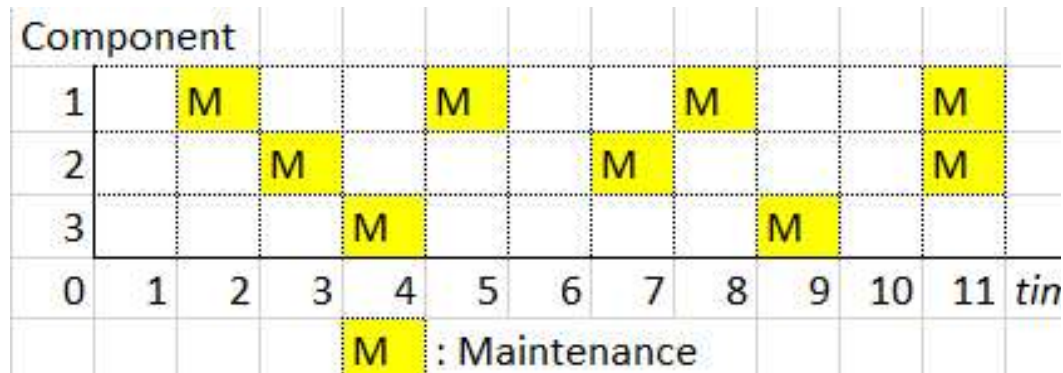
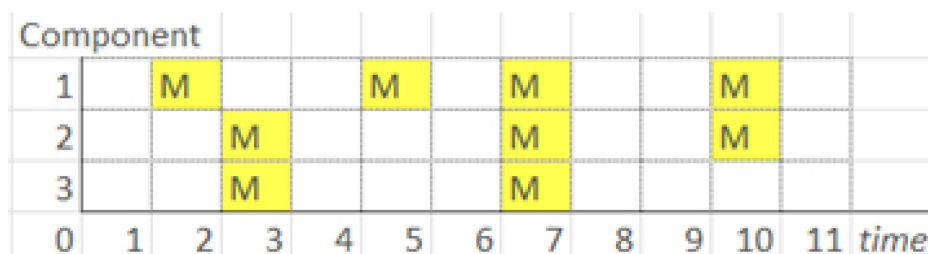


Figure 1 Planned intervention strategy

Component	c_i	c_s	t_m (hrs)	c_p
1	4	0,5	2	
2	2	0,5	2	1,5
3	3	0,4	3	

Table 1 Intervention cost, intervention time, and possession cost

Based on that, the infrastructure manager comes up with 4 strategies. Which one should be selected for the railway line?

☐


☒

Component												
1		M			M			M			M	
2			M				M				M	
3			M					M				
	0	1	2	3	4	5	6	7	8	9	10	11 time

☐

Component												
1	M			M			M			M		
2			M				M			M		
3				M					M			
	0	1	2	3	4	5	6	7	8	9	10	11 time

☐

Component												
1		M			M			M			M	
2		M			M				M			
3				M					M			
	0	1	2	3	4	5	6	7	8	9	10	11 time

Quiz score: **16** out of 20