EDITAL PPGT Nº 04/2022 - SELEÇÃO DE CANDIDATOS ÀS VAGAS DO PROGRAMA DE PÓS-GRADUAÇÃO EM TRANSPORTES PARA O CURSO DE MESTRADO ACADÊMICO COM INGRESSO NO PRIMEIRO PERÍODO LETIVO DE 2023

PROVA DE MÚLTIPLA ESCOLHA

Leia com atenção as instruções abaixo:

1. A prova terá a duração total de **1h30min (uma hora e trinta minutos)**, sendo realizada em 3 (três) etapas subsequentes de 30 (trinta) minutos cada, já incluído o tempo de preenchimento dos respectivos formulários de respostas no *Google Forms*.

2. Ao final de cada etapa, o respectivo formulário será fechado para recebimento de respostas.

3. A resolução da prova será acompanhada por um responsável do PPGT por meio de chamada de vídeo realizada via *Microsoft Teams*.

4. Durante a realização da prova, o candidato deverá manter a câmera ligada e direcionada para si, de tal modo que o responsável pela aplicação da prova possa visualizá-lo.

5. Cabe ao candidato buscar a infraestrutura de acesso à internet que seja segura para a realização da prova. O Programa não se responsabiliza por problemas de ordem técnica que possam ocorrer com cada candidato.

6. O candidato receberá, no e-mail declarado no momento da inscrição no processo seletivo, os cadernos de questões de múltipla escolha e o link de acesso aos formulários eletrônicos para o preenchimento das respostas.

7. Cada caderno de questões e o respectivo formulário serão compostos por 10 (dez) questões de múltipla escolha. Para que ocorra o registro das respostas é necessário clicar no botão “enviar” após finalizar o preenchimento das respostas de cada formulário.

8. Será eliminado o candidato que não tiver finalizado e enviado pelo menos um dos três formulários.

9. Não será permitida a interferência e/ou a participação de outras pessoas, salvo em caso de candidato que tenha solicitado condição especial, em função de deficiência que impossibilite a realização da prova pelo próprio candidato.

10. Durante a realização da prova, o candidato não deverá se comunicar com outros candidatos nem sair da frente da câmera sem a autorização do responsável pela aplicação da prova.

11. A desobediência de qualquer uma das determinações constantes nas instruções acima e no edital implicará na eliminação do candidato.

Identificação do Candidato

Nome completo:	
Inscrição:	**ID:**

AVISO

Durante a realização da prova, tanto as questões quanto as opções de resposta foram disponibilizadas de forma aleatória para cada candidato. Por isso, as questões e as opções de resposta do presente gabarito não estão numeradas. Para fazer a verificação das respostas, busque o enunciado correspondente.

QUESTION

The text below is from the paper of Vogelpohl *et al.* (2018), "Transitioning to manual driving requires additional time after automation deactivation":

"*Additional factors seem to influence the time to transition back to manual driving. Three factors have emerged in several studies as likely causes for delayed reactions in a take-over situation: The quality of automation monitoring through the driver, the characteristics of the NDRT (non-driving related tasks) and the complexity of the situation to which the driver has to react.*"

Thus, based on the text above, it can be concluded:

I. The degree to which automation is monitored can affect the transition from automated to manual driving.
II. Characteristics of the tasks performed during automated driving can influence the ability to take back manual control and the speed of the transition to manual driving.
III. The complexity of the situation in which a TOR (take-over request) is triggered has been identified to affect the take-over time.
IV. *"The quality of automation monitoring through the driver, the characteristics of the NDRT (non-driving related tasks) and the complexity of the situation to which the driver has to react"* cannot be considered as factors that influence the TOR.

Based on these affirmatives:

- Only option I is correct.
- Options I, II and IV are correct.
- Options I and IV are correct.
- Options I, III and IV are correct.
- Options I, II and III are correct.

QUESTION

From the paper of Gao *et al.* (2022), "Design of an Intelligent Platoon Transit System towards Transportation Electrification", based on Figure 5, it is correct to say that:

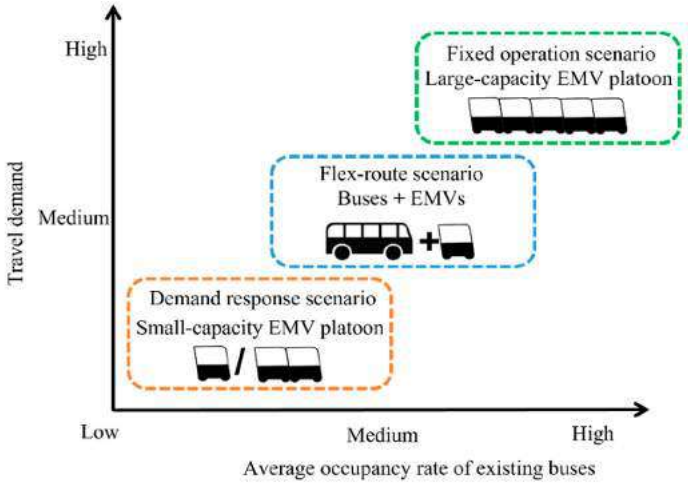

Figure 5. Three application scenarios with varying travel demands and average occupancy of existing buses.

- The Demand Response Scenario is an application scenario when the average bus occupancy rate of existing buses is LOW and the travel demand is HIGH.
- The Demand Response Scenario is an application scenario when the average bus occupancy rate of existing buses is LOW and the travel demand is LOW.
- The Demand Response Scenario is an application scenario when the average bus occupancy rate of existing buses is HIGH and the travel demand is HIGH.
- The Demand Response Scenario is an application scenario when the average bus occupancy rate of existing buses is HIGH and the travel demand is MEDIUM.
- The Demand Response Scenario is an application scenario when the average bus occupancy rate of existing buses is MEDIUM and the travel demand is HIGH.

QUESTION

According to the text below extracted from Li and Da Silva (2022), "Assessing the safety effect of red-light camera deactivation: a geographically weighted negative binomial regression approach", automatic red-light cameras have several features, except:

"Automatic red-light cameras combine sensing, automation, and photographic technologies. They have the ability to detect incidents when a vehicle enters an intersection after the traffic light signal turns red, automatically activate cameras to take pictures, and record a series of photographs and/or video images of the vehicle movement, date and time durations of the incidents (Retting et. al., 1999; TTI, 2012). The pictures and videos can be used as evidence of traffic violations. It is expected that drivers are more likely to stop at intersections where automatic red-light cameras are implemented in order to avoid traffic citations, therefore reducing crashes."

- Taking pictures of the vehicles.
- Recording videos and automatically sending them to drivers.
- Being activated automatically to take pictures.
- Assisting the authorities to avoid traffic crashes.
- Recording the time duration and the date of the incidents.

QUESTION

According to the text reproduced below from the paper by Yang *et al.* (2020), "The marginal cost of traffic congestion and road pricing: Evidence from a natural experiment in Beijing", how do author's estimates of

MECC differ from those obtained by OLS?

"…our study provides the first empirical estimates of MECC and an empirical road map for designing road pricing schemes in China based on fine-scale traffic data rich in both temporal and spatial dimensions. This type of data is becoming increasingly available to researchers. Although there exist a number of studies that estimate the MECC in developed countries such as Canada and the United States (e.g., Walters 1961; Kraus, Mohring, and Pinfold 1976; Keeler and Small 1977; Dewees 1979; Parry and Small 2009), there is a lack of evidence from developing countries, where traffic congestion is becoming one of the most pressing urban challenges since it affects the quality of life in major urban areas. Rigorous empirical analysis to measure MECC is the first step toward designing market-based mechanisms to effectively address this challenge."

- There is no basis for comparison of both estimates.
- There is no significant difference between these estimates.
- OLS estimates are typically higher.
- OLS estimates have a downward bias.
- OLS methods overestimate MECC.

QUESTION

Considering the paper of Maneenop and Kotcharin (2020), "The impacts of COVID-19 on the global airline industry: An event study approach", what can be concluded if the result of equation (2) below is statistically significant equal to zero?

$$AR_{i,t} = R_{i,t} - \hat{a}_i - \hat{\beta}_i R_{m,t} \qquad (2)$$

where $R_{i,t}$ and $R_{m,t}$ are daily returns of stock *i* and daily market index returns on stock market *m* at time *t*, respectively, $\hat{a}_i$ and $\hat{\beta}_i$ are the estimated parameters of stock *i*, and $AR_{i,t}$ captures the impact of the event when the information of the three above mentioned events is announced to the markets.

- One can conclude that the airline's stock return was affected by the events considered.
- One can conclude that the error term in equation (2) is not identically distributed.
- We can conclude that the airline obtained abnormal returns.
- One can conclude that the airline's stock return was not affected by the events considered.
- None of the above.

QUESTION

The article of Rokicki *et al.* (2020), "Changes in Logistics Activities in Poland as a Result of the COVID-19 Pandemic" aims to identify changes in logistics activities resulting from the COVID-19 pandemic. According to the text below, which alternative does not contain changes found within the scope of the logistical activities studied?

"*Using the method of purposive selection, Poland, which is well developed in logistics and aspires to be a crucial logistical hub of Europe, was selected for the study. The analysed period covered the years 2015–2021. The material sources were the literature on the subject and data from reports on individual logistics segments. Dynamic indicators with a fixed and variable base, coefficient of variation and Kendall's tau correlation coefficient were used for analysis and presentation. It was found that the COVID-19 pandemic accelerated changes in logistics activities. These changes included digitalisation, the development of the e-commerce market, multi-channel sales and the development of these services, and the introduction of automation and artificial intelligence. In all activities, 2020 was the most challenging year, but there was generally a reduction in revenue growth and, less often, stagnation. Logistics companies gained in the second year of the pandemic (2021) when implemented solutions generated record revenues. Among the winning segments were logistics services in general, especially sea freight forwarding, warehousing services,*

courier services related to e-commerce, and a lesser extent, freight transport. Losses were incurred in the segment related to passenger transport"

- Digitalisation.
- Development of the e-commerce market.
- Generalized increase in the cost of logistics activities.
- Introduction of automation and artificial intelligence.
- Multi-channel sales.

QUESTION

According to the paper of Marrekchi *et al.* (2021), "A review of recent advances in the operations research literature on the green routing problem and its variant", and the text below, the following sentence is correct about the Green Vehicle Routing Problem (GVRP):

"*The GVRP is concerned with the minimization of emissions of transportation activities and is an extension to the well-known VRP. The VRP is the basic operational-level transportation problem for logistics companies who are looking for finding optimal routes and schedules for a set of vehicle feets to satisfy the demands of geographically-scattered customers. The GVRP extends the classical definition of the VRP by considering the environmental impacts of transportation. Since 2007, the concept of GVRP has emerged and received a great deal of attention from academia. Based on these seminal works proposed by Sbihi and Eglese (2007, 2010), academics and researchers have been working on the development of new variants for the VRP concerned with emissions (or FC) minimization*"

- The development of the GVRP was not an extension of the well-known VRP (Vehicle Routing Problem) model.
- The GVRP tries to minimize only the costs of the vehicle drivers.
- The first well known GRVP model was introduced by Dantzig and Ramser (1959) and it aimed to find the best itinerary visiting all the nodes of the network.
- The GVRP is concerned with the minimization of emissions of transportation activities.
- The GVRP model does "not" try to harmonize the environmental and economic costs of the routes.

QUESTION

According to Fig. 1 below extracted from the paper of Faber *et al.* (2021), "The role of travel-related reasons for location choice in residential self-selection", we can affirm that:

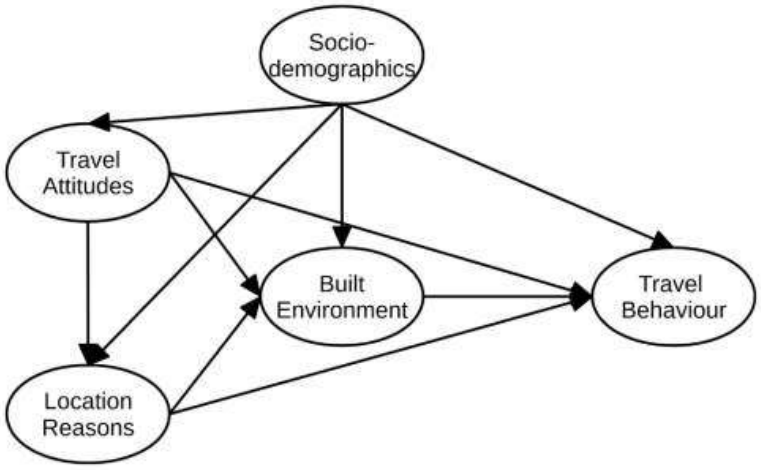

Fig. 1. Conceptual model of the concepts and relationships studied in this paper.

- Built environment is the prior concept used in the model.
- Socio-demographics are assumed to affect all concepts presented in the study.
- There is a direct effect of built environment on travel attitudes.
- Travel attitudes are affected by location reasons.
- All of the above.

QUESTION

According to Figure 2 extracted from Vaddadi et al. (2020), "Measuring System-Level Impacts of Corporate Mobility as a Service (CMaaS) Based on Empirical Evidence", the KPIs (key performance indicators) chosen to evaluate impacts at the Individual Level are:

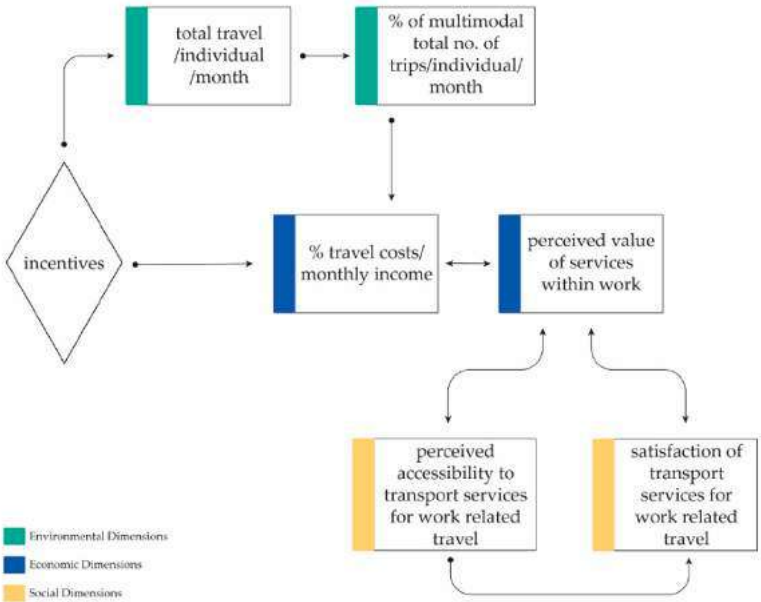

Figure 2. Interactions among environmental, economic, and social dimension on the individual level.

- Travel Behavior, Travel Costs, Accessibility and Quality of Travel.
- Employment, Travel Costs, Accessibility and Quality of Travel.

- Travel Behavior, Business Models, Accessibility and Quality of Travel.
- Travel Costs, Mobility and Quality of Life, Travel Behavior.
- Employment, Travel Costs, Accessibility and Travel Behavior.

QUESTION

Based on the text below from the paper of Medury and Grembek (2016), "Dynamic programming-based hot spot identification approach for pedestrian crashes", is correct to affirm that:

"*The crash data for this study consists of fatal and non- fatal crashes involving pedestrians in California during the years 2005–2010, extracted from California Department of Transportation's Traffic Accident Surveillance and Analysis System (TASAS). Since the data corresponding to pedestrian and/or traffic exposure were not available for the study, the state highway system was divided into homogeneous segments on the basis of the route number, county, route suffix and prefix. For each of those relatively homogeneous segments, sliding window and dynamic programming were used to identify hot spots. In addition, TASAS also contains a repository of the postmiles of 22,725 intersections along the state highway network, which were used to identify hot spots using the buffer-based approach*."

- The traffic data for the study were collected in the 22,725 intersections in California for 5 years.
- The traffic data for the study were extracted from the California Department of Transportation's Traffic Accident Surveillance and Analysis System (TASAS) for 5 years.
- The crash data for the study is related to 5 years and were obtained from the Surveillance and Analysis System of California state.
- The crash data for the study is related to all fatal crashes in California during the years 2005–2010.
- The homogeneous segments definition was based on data obtained from California Department of Transportation's Traffic Accident Surveillance and Analysis System (TASAS).

QUESTION

"Take-over time equal to take-over quality?" is a question presented in the manuscript of Vogelpohl *et al.* (2018) "Transitioning to manual driving requires additional time after automation deactivation." The authors explain that:

"…. It becomes apparent, that the take-over time can only reflect one aspect of a drivers' readiness to retake control, especially in complex driving situations. To supplement and validate the take-over times it is therefore crucial to define additional measures of take-over quality. To define a sufficient time period for a safe transition of control, different measures for the readiness to react after a TOR need to be analyzed."

It means that:

- The take-over times measured in some studies do not represent drivers' capacity to take over control of the car when they did safely.
- The take-over quality is not affected by drivers' readiness to retake control, especially in complex driving situations.
- To supplement and validate the take-over times it is therefore crucial to define additional measures of take-over quality.
- Longer take-over times are not relevant when analyzing the quality of the driver's driving.
- The manuscript's author considers that treating different measures for the readiness to react after a take-over request is not relevant. Therefore, it is not necessary to analyze it.

QUESTION

From the paper of Gao *et al.* (2022), "Design of an Intelligent Platoon Transit System towards Transportation Electrification", based on Figure 7 below, it is correct to say that:

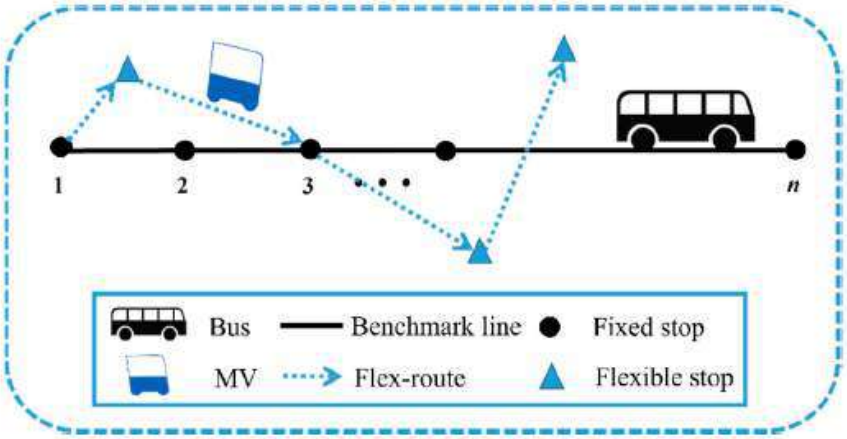

Figure 7. Flex-route scenario with linkage operation of EMVs and buses.

- In Scenario 2, the Electric Modular Vehicles (EMV) would operate for complementary travel demands not met by the buses.
- In Scenario 2, the Electric Modular Vehicles (EMV) would operate for heavy travel demands and large capacity, and need to form platoon to pick up passengers on the bus lines.
- In Scenario 2, the Electric Modular Vehicles (EMV) would operate for low travel demands and low capacity, and operate as the leader to pick up passengers instead of the buses.
- In Scenario 2, the Electric Modular Vehicles (EMV) would operate for low travel demands and high capacity, and operate in platoon to pick up passengers improving of the capacity of buses.
- In Scenario 2, the Electric Modular Vehicles (EMV) would operate for high travel demands and low capacity, and operate as a replacement of the bus lines.

QUESTION

Considering Table 5 extracted from Li and Da Silva (2022), "Assessing the safety effect of red-light camera deactivation: a geographically weighted negative binomial regression approach", and knowing that a smaller AICc indicates a better model, then it is possible to say that the best model was:

Table 5 Optimum bandwidth estimates

Model	Method	Type	Golden	b	L	AICc
NBR					-2001.6948	4009.4238
GWNBR	Fixed	AIC	3814.6161	3321.7234	-2230.977	4598.5983
GWNBR	Fixed	CV	65,548.103	8981.9775	-1960.815	3946.6971
GWNBR	Adaptive	AIC	3747.0802	42	-1.6752E8	335,043,958
GWNBR	Adaptive	CV	65,715.619	318	-1963.479	3950.7566

- GWNBR with Method=Fixed and Type=AIC.
- GWNBR with Method=Adaptive and Type=AIC.
- GWNBR with Method=Fixed and Type=CV.
- NBR.
- GWNBR with Method=Adaptive and Type=CV.

QUESTION

According to the text reproduced below from the paper of Yang *et al.* (2020), "The marginal cost of traffic congestion and road pricing: Evidence from a natural experiment in Beijing", the following is one of the main contributions of the authors:

"*Our study makes the following two contributions to the literature. First, to our knowledge, this is the first attempt to empirically estimate the marginal cost of traffic congestion while addressing the endogeneity issue in the relationship between traffic speed and density (or flow) using real-time traffic data. Existing studies are mostly based on engineering estimates of the speed-flow relationship rather than empirical estimates of the relationship (Lindsey and Verhoef 2007, Parry and Small 2009). While the endogeneity issue in the speed-flow (or speed-density) relationship has been recognized (Small and Chu 2003), it has rarely been addressed in empirical settings perhaps due to the view that the relationship is a mechanical one and the challenge in finding a valid instrumental variable. One exception is Couture, Duranton, and Turner (2018), which investigates the determinants of driving speed in large US metropolitan statistical areas (MSAs) using household travel survey data. Their study addresses the endogeneity in the speed (or the inverse supply) function by instrumenting for trip distance using the mean distance of other trips for the same purpose in the same MSA or a set of trip type dummies. Our paper differs from their paper in terms of methodology, data, and identification strategy. Our empirical framework focuses on the relationship between traffic speed and density and utilizes real-time traffic data on speed and volume from traffic microwave censors for a large number of road segments in single city. We leverage the unique driving restriction policy as a natural experiment for identification. Consistent with their finding, our result show that OLS underestimates the slope of the (inverse) supply curve and hence the marginal external cost of congestion*."

- Confirmation of the fact that Beijing is one of the most congested cities in the world.
- Empirical estimates of MECC based on fine-scale data rich in both temporal and spatial dimensions.
- Application of OLS methods to the estimation of MECC.
- Use of instrumental variables to measure the average speed of traffic.
- None of the above.

QUESTION

Consider the article of Maneenop and Kotcharin (2020), "The impacts of COVID-19 on the global airline industry: An event study approach". From the results in Table 1, which statistical test did the authors use to assess whether the recent global health crisis affected the price of airline common stock?

"*Table 1 presents the cumulative abnormal returns of airlines stocks in each country during three different event windows for the three major events based on the individual countries. We exclude Chile and South Africa in this section because they have only one listed airline firm in the sample. At the first glance, the mean and median of the cumulative abnormal returns in most cases are negative, especially on the event date [0,0] and five days after the event date [0,+5]. We employ both parametric and nonparametric tests for the equality of the mean and median values, respectively. Overall, the t-test and the Wilcoxson signed rank test provide similar results with greater statistical significance shown in the nonparametric test*."

Table 1
Cumulative abnormal returns in individual countries during different event window periods.

Market	Window	Event 1 (Jan 13, 2020)				Event 2 (Feb 21, 2020)				Event 3 (Mar 11, 2020)			
		Mean	Median	*t*-test	Wilcoxon	Mean	Median	*t*-test	Wilcoxon	Mean	Median	*t*-test	Wilcoxon
Pre-event													
Australia (4)	[-5, 0]	−2.41	−2.40	−2.440[a]	−1.461	−0.29	−0.47	−0.249	−0.365	−17.84	−14.57	−2.836[a]	−1.826[a]
Canada (5)	[-5, 0]	0.97	−0.10	0.617	−0.405	−3.41	−2.77	−1.366	−1.214	−4.63	−6.23	−1.947	−1.483
China (8)	[-5, 0]	0.99	−0.10	1.109	−0.560	1.64	0.25	0.883	0.280	7.07	6.15	4.393[c]	2.521[b]
India (4)	[-5, 0]	8.16	2.02	1.023	1.095	2.91	1.10	1.405	1.826[a]	−2.86	−0.30	−0.892	−0.365
S. Korea (7)	[-5, 0]	−3.24	−4.23	−1.540	−1.183	−4.62	−6.07	−2.172[a]	−1.690[a]	−1.55	0.51	−0.345	−0.845
Thailand (4)	[-5, 0]	−2.74	−3.01	−2.782[a]	−1.826[a]	−5.76	−5.63	−3.073[a]	−1.826[a]	5.57	7.38	0.740	0.730
U.K. (5)	[-5, 0]	2.29	6.01	0.589	0.674	1.22	0.10	1.193	0.674	−2.52	−1.40	−1.099	−1.214
U.S. (13)	[-5, 0]	−3.29	−1.89	−1.776	−3.040[c]	−3.12	−3.45	−6.436[c]	−3.180[c]	−0.54	−2.50	−0.179	−0.524
On-event													
Australia (4)	[0, 0]	0.67	0.38	1.553	1.826[a]	0.26	0.34	0.273	0.730	−4.20	−4.83	−4.172[b]	−1.826[a]
Canada (5)	[0, 0]	0.53	0.48	1.472	1.214	−1.38	−0.52	−1.628	−2.023[b]	−3.77	−4.36	−3.143[b]	−2.023[b]
China (8)	[0, 0]	−0.13	−0.40	−0.263	−0.700	−1.15	−1.66	−1.863	−1.540	3.59	2.63	3.533[c]	2.521[b]
India (4)	[0, 0]	0.57	0.07	0.399	0.730	0.13	0.00	0.778	0.365	−3.06	−3.99	−2.938[a]	−1.461
S. Korea (7)	[0, 0]	−0.50	−0.70	−0.874	−1.014	−0.13	−0.36	−0.171	−0.338	−0.20	0.95	−0.175	−0.676
Thailand (4)	[0, 0]	1.48	0.95	1.921	1.826[a]	−1.14	−1.31	−0.94	−1.095	−0.10	0.13	−0.073	−0.365
U.K. (5)	[0, 0]	−2.77	−0.85	−0.856	−0.944	−0.34	−0.33	−0.791	−0.405	−1.65	−0.32	−0.717	−0.674
U.S. (13)	[0, 0]	−0.91	−0.69	−2.658[b]	−2.621[c]	0.38	0.25	1.254	1.013	−1.45	−0.72	−1.303	−1.013
Post-event													
Australia (4)	[0,+5]	−0.48	−1.96	−0.263	−0.365	−8.78	−6.27	−2.089	−1.826[a]	−25.10	−28.87	−3.441[b]	−1.826[a]
Canada (5)	[0,+5]	0.05	−0.12	0.040	−0.674	−5.66	−5.79	−2.215[a]	−2.023[b]	−36.89	−49.95	−3.311[b]	−2.023[b]
China (8)	[0,+5]	−2.75	−4.76	−1.545	−1.120	−2.86	−3.60	−1.323	−1.400	−2.79	−2.36	−1.544	−1.400
India (4)	[0,+5]	0.57	1.73	0.319	0.365	−0.86	−0.93	−0.337	−0.365	−6.71	−5.44	−0.870	−1.095
S. Korea (7)	[0,+5]	−2.38	−3.95	−2.108[a]	−1.690[a]	5.31	3.62	0.957	0.676	−8.24	−3.15	−1.947[a]	−1.690[a]
Thailand (4)	[0,+5]	1.56	1.65	1.990	1.461	−14.44	−9.96	−2.339	−1.826[a]	−8.13	−8.41	−6.148[c]	−1.826[a]
U.K. (5)	[0,+5]	−4.03	−4.47	−1.668	−1.483	−14.68	−18.55	−2.047	−1.483	−53.73	−54.51	−2.786[b]	−1.753[a]
U.S. (13)	[0,+5]	−3.27	1.07	−0.706	1.153	−10.62	−10.69	−8.436[c]	−3.180[c]	−32.42	−38.53	−3.285[c]	−2.411[b]

The numbers shown in the parentheses are the number of airline firms.
[a] Statistical significance at the 10% level.
[b] Statistical significance at the 5% level.
[c] Statistical significance at the 1% level.

- Student's t-test.
- Window test.
- Wilcoxson test.
- Farrar-Glauber test.
- None of the previous items.

QUESTION

In the article of Rokicki *et al.* (2020), "Changes in Logistics Activities in Poland as a Result of the COVID-19 Pandemic", the authors have chosen Poland as the object of study by several factors. Following the text below, mark the alternative that does not represent a factor used by the authors to justify the choice of Poland.

"*The scale and unpredictability of the phenomenon certainly had a significant impact on the situation and changes in logistics operations. Poland is a rapidly developing country. In addition, it has an excellent location, which means that many companies are locating their logistics and warehousing in Poland. Poland is the hub of Central and Eastern Europe, resulting in many logistics companies operating in the country, including those with a global reach. The conjuncture before the pandemic was very good. The changing playing field may also have caused changes in the logistics business. The new aspect of this article is the presentation of a comprehensive analysis of the impact of COVID-19 on logistics activities in one of the most important countries in Europe in terms of logistics. In addition, reference has been made to the most critical logistics segments, which makes it possible to show the outflow of the pandemic in different areas of logistics activities. A problem and limitation is the lack of comprehensive data available. Poland is one of the largest countries in the European Union, with an excellent geographical location in Europe. There are many global logistics companies in this country. Logistics is also developing rapidly. Poland already fulfils vital functions in Central and Eastern Europe and could become Europe's most important logistics hub in the future. The research period covered the years 2015–2021. The adoption of such a period is substantively justified. By 2019, changes in logistics activities resulting from the normal functioning of the economy can be observed. In 2020, there was an economic crisis caused by the COVID-19 pandemic. The European*

continent was quite severely affected by COVID-19. The last year in which complete research data were available was 2021. In addition, it was the second year of the COVID-19 pandemic."

- A capitalist country with high per capita income.
- One of the largest countries in the European Union.
- An excellent geographical location in Europe.
- There are many global logistics companies in Poland.
- Logistics is also developing rapidly in Poland.

QUESTION

The paper of Marrekchi *et al.* (2021), "A review of recent advances in the operations research literature on the green routing problem and its variant", shows the relevance of the negative externalities per transportation mode in Table 1. According to this table, the following sentence presents a correct order for the relevance of the negative externalities (the symbol ≤ means that the left side is less relevant than the right side:

Table 1 Relevance of the negative externalities per transportation mode by Demir et al. (2015)

Negative externalities	Road transportation	Rail transportation	Maritime transportation	Air transportation	Pipeline transportation
Air pollution	***	**	**	**	*
Greenhouse Gases	***	**	**	**	*
Noise pollution	***	**	**	**	*
Water pollution	*	*	***	*	*
Congestion	***	*	*	*	*
Accidents	**	*	*	*	*
Land use	**	**	*	*	*

*: Low ** Medium *** High

- For the Road Transportation mode: (air pollution) ≤ (water pollution) ≤ (green house gases) ≤ (accidents).
- For the Maritime Transportation mode: (water pollution) ≤ (green house gases) ≤ (congestion) ≤ (air pollution).
- For the Rail Transportation mode: (green house gases) ≤ (water pollution) ≤ (land use) (water pollution) ≤ (accidents).
- For the Road Transportation mode: (water pollution) ≤ (land use) ≤ (accidents) ≤ (air pollution).
- For the Maritime Transportation mode: (water pollution) ≤ (noise pollution) ≤ (congestion) ≤ (Land use).

QUESTION

Based on the results presented in Table 3 from the paper of Faber *et al.* (2021), "The role of travel-related reasons for location choice in residential self-selection", consider the statements below and choose the correct answer.

Table 3
Built environment clusters and factor loadings.

Computed distance between the home and …	Centrality	Bus stop	Tram/metro stop
Nearest city centre	0.826		
Nearest highway entry- or exit ramp	0.674		
Nearest intercity train station	0.861		
Nearest train station	0.617		
Nearest bus stop that is serviced at least 4x / hour	0.514	0.404	
Nearest bus stop that is serviced at least 2x / hour		0.761	
Nearest bus stop that is serviced at least 1x / hour		0.870	
Nearest bus stop		0.737	
Nearest metro or light rail stop			0.976
Nearest tram stop			0.977

I. The dimensions were generated by clustering distances.
II. High-loading indicators appear to the distance to a tram/metro station for one dimension and the distance to bus stations for the other.
III. Centrality appear to be the dimension with more distance variations.

- All statements are correct.
- Only statements I and II are correct.
- Only statements I and III are correct.
- Only statement II is correct.
- All statements are incorrect.

QUESTION
According to Figure 3 extracted from Vaddadi et al. (2020), “Measuring System-Level Impacts of Corporate Mobility as a Service (CMaaS) Based on Empirical Evidence”, the KPIs (key performance indicators) chosen to evaluate impacts on Company Level are:

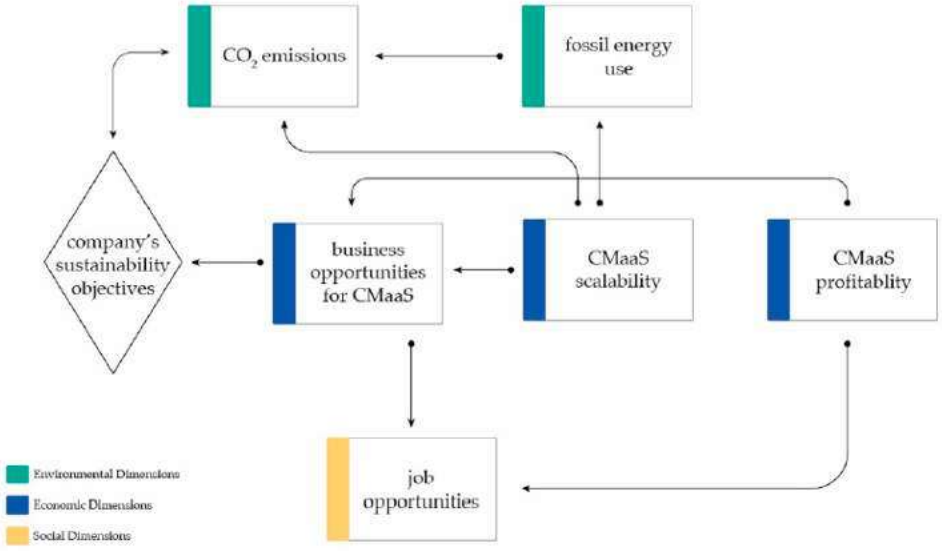

Figure 3. Interactions among environmental, economic, and social dimensions on the company level.

- Business Models, Employment, Travel Behavior.
- Energy use & Emissions, Employment, Travel Behavior.
- Travel Costs, Mobility and Quality of Life.
- Travel Behavior, Energy use & Emissions, Employment.
- Energy use & Emissions, Business Models, Employment.

QUESTION

Considering Figure 4 below extracted from the paper of Medury and Grembek (2016), it is correct to say that:

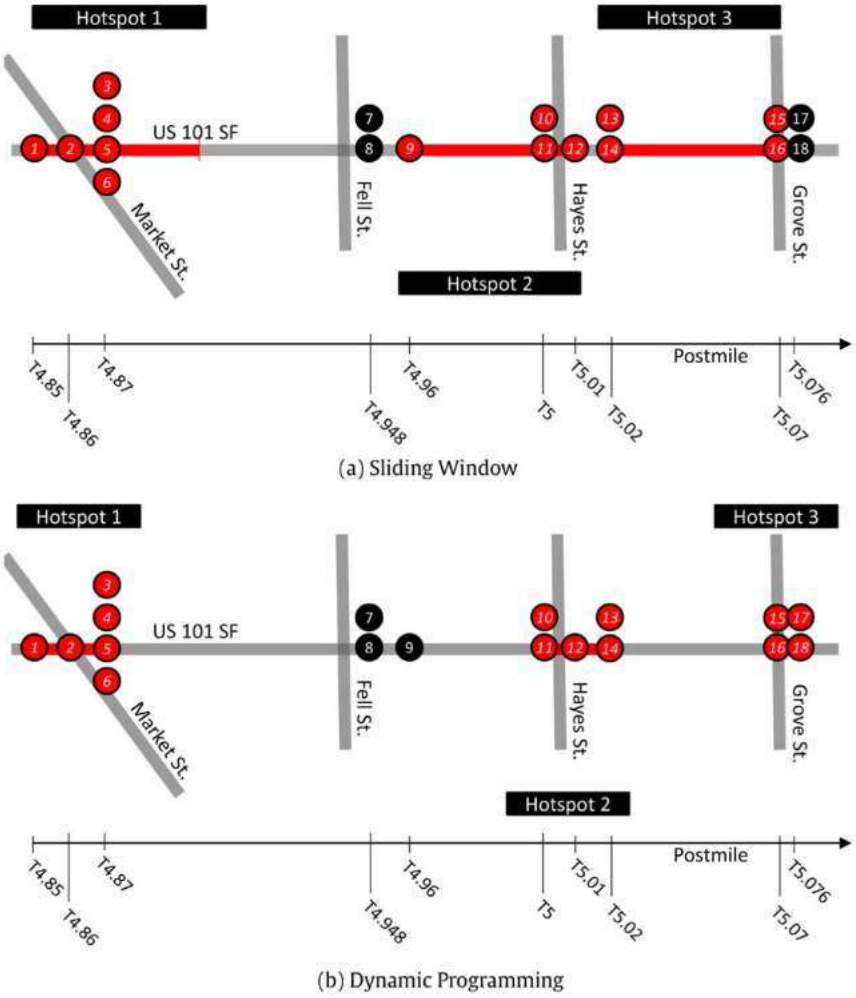

Fig. 4. Comparison between dynamic programming and the sliding window method for the case study from US 101.

I. Even though both approaches identified three hot spots, the sliding window approach covered more crashes with a smaller hot spot coverage length.
II. Even though both approaches identified three hot spots, the dynamic programming approach covered more crashes with a smaller hot spot coverage length.
III. The crashes 7, 8 and 9 are on the second hotspot defined by the dynamic programming approach.
IV. The crashes 10, 11, 12, 13 and 14 are on the second hotspot defined by the sliding window approach.

In relation to the statements above, choose the correct answer:

- All statements are correct.
- Only statement I is correct.
- Only statement II is correct.
- Only statements I and III are correct.
- Only statements II and IV are correct.

QUESTION

From the manuscript of Vogelpohl *et al.* (2018), “Transitioning to manual driving requires additional time

after automation deactivation", M01 to M05 represent the take-over scenarios defined in their study. TOR is defined as the take-over request. Vertical line marks onset of event. According to Fig. 8 below, one can affirm that:

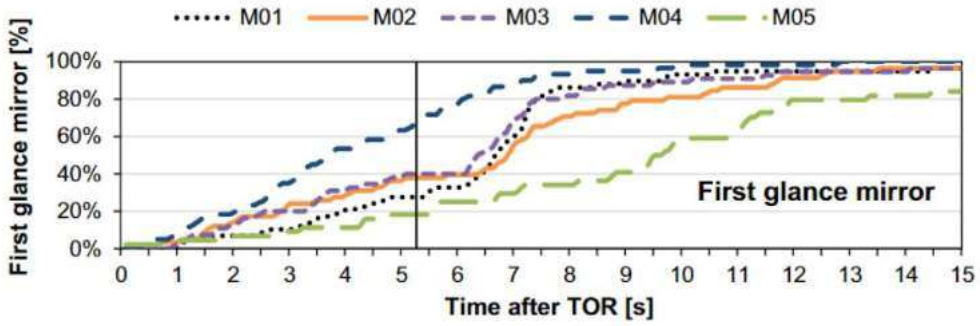

Fig. 8. Cumulative percentage of first glance to the mirror after the TOR collapsed across all NDRT conditions. Vertical line marks onset of event.

- At TOR equal to 7s, considering M02, more than 80% of the participants did the first glance at the mirror.
- For M01, less than 20% of the participants did the first glance at the mirror at 5.5 s.
- Considering M04, more than 40% of the participants did the first glance in the mirror at 5.5 s.
- Considering a cumulative percentage graph, it is expected that curves to tend to 100%, as seen in M01 to M04.
- None of the above.

QUESTION

From the paper of Gao *et al.* (2022), "Design of an Intelligent Platoon Transit System towards Transportation Electrification", based on Figure 8 below, it is correct to say that:

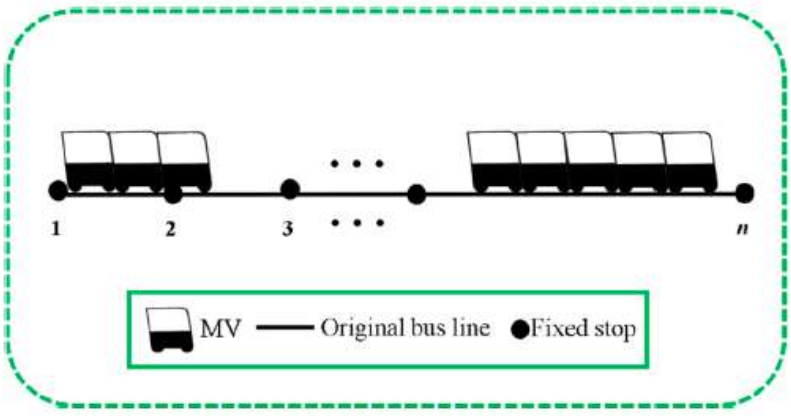

Figure 8. Regular operating scenario with large volume.

- In Scenario 3, the platoon of Electric Modular Vehicles (EMV) would operate as a supplementary role and pick up the remaining demand of the buses**.**
- In Scenario 3, the platoon of Electric Modular Vehicles (EMV) would simply operate to meet regions with small and sparse demand.
- In Scenario 3, the platoon of Electric Modular Vehicles (EMV) would operate differently from the original bus lines, suitable for medium capacity, and need to form platoon for lower demands.
- In Scenario 3, the platoon of Electric Modular Vehicles (EMV) would simply operate as the

original bus lines for large capacity, and could decouple for lower demands.

- In Scenario 3, the Electric Modular Vehicles (EMV) would operate in different lines, complementary to the original bus lines, platooning for higher demands.

QUESTION

Considering Fig. 2 extracted from Li and Da Silva (2022), "Assessing the safety effect of red-light camera deactivation: a geographically weighted negative binomial regression approach", the bandwidth size which has the least number of points inside it is:

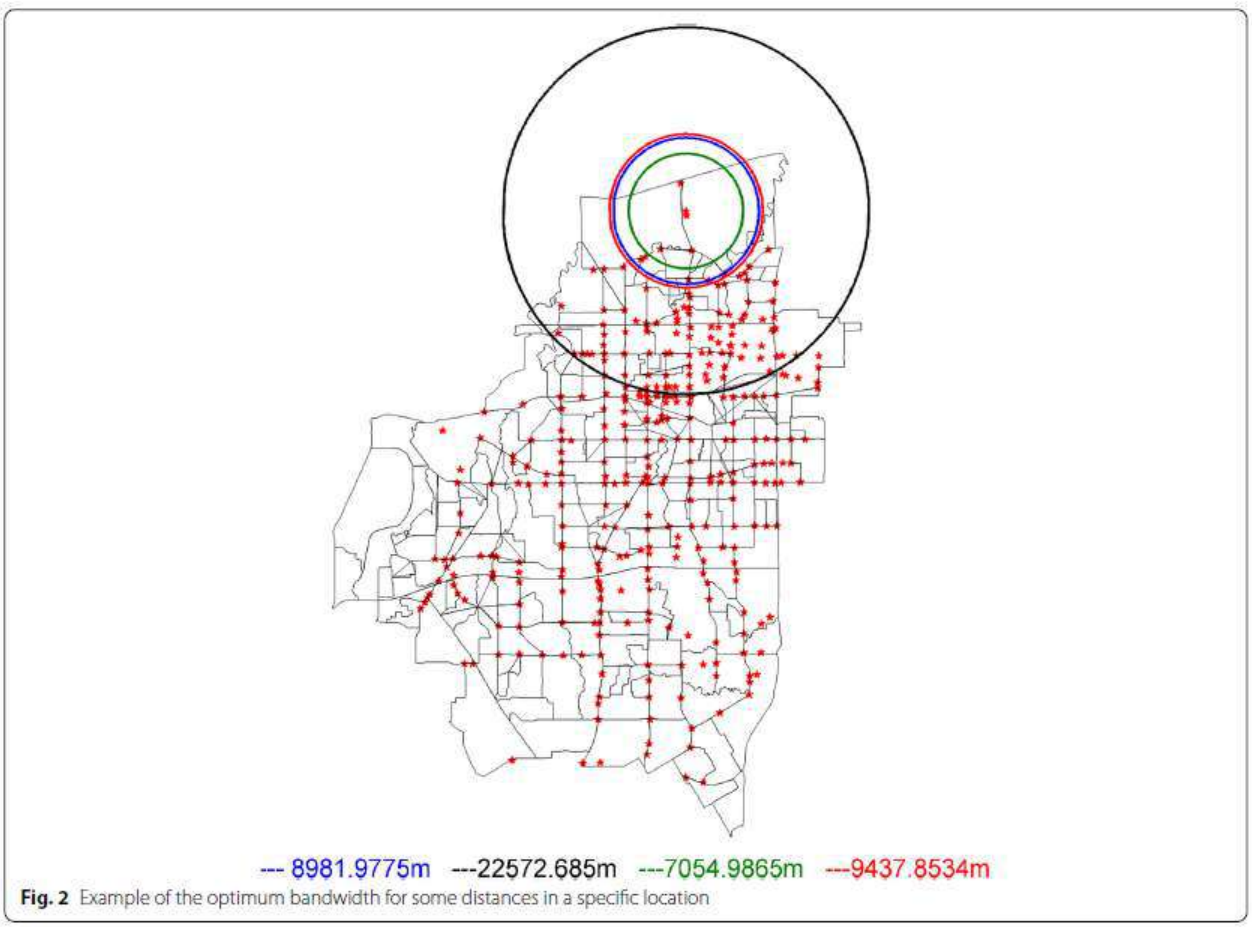

Fig. 2 Example of the optimum bandwidth for some distances in a specific location

- Around 9.4 km.
- Around 9 km.
- Around 7.1 km.
- Around 22 km.
- Around 6.9 km.

QUESTION

According to the text reproduced below from the paper of Yang *et al.* (2020), "The marginal cost of traffic congestion and road pricing: Evidence from a natural experiment in Beijing", endogeneity appears in:

"In the theoretical model presented above and in the transportation engineering literature, it is assumed that traffic density affects average vehicle speed and not vice versa, and that this relationship is deterministic. In practice, average vehicle speed can be affected by a variety of other (human and

nonhuman) factors that researchers do not observe, as discussed above. In addition, both average vehicle speed and traffic density are realized simultaneously and affect each other. Road users decide whether they should take a trip or not based on the prevailing cost of the trip, which includes the level of traffic congestion on the road. If a road user observes or expects traffic congestion due to accidents, big events, or road construction, she might consider rescheduling the trip or changing route, which would in turn affect traffic density. This simultaneity would give rise to endogeneity in traffic density in equation (5).”

We specify the following relationship between traffic speed and density:

$$(5) \quad Speed_{it} = \alpha + \beta Density_{it} + Weather_t\gamma + Month_t + Hour_t + Week_t + Holiday_t + Road_i + Ring_i \times Hour_t + \varepsilon_{it},$$

- The analysis of traffic data.
- The determination of the optimal congestion charges.
- The relationship between traffic speed and traffic density.
- The examination of road-pricing schemes.
- None of the above.

QUESTION

From Table 1 extracted from the article of Maneenop and Kotcharin (2020), “The impacts of COVID-19 on the global airline industry: An event study approach”, which countries showed cumulative abnormal returns different from zero at 5% significance level after the event considered – post-event (based on the non-parametric test)?

Table 1
Cumulative abnormal returns in individual countries during different event window periods.

Market	Window	Event 1 (Jan 13, 2020)				Event 2 (Feb 21, 2020)				Event 3 (Mar 11, 2020)			
		Mean	Median	*t*-test	Wilcoxon	Mean	Median	*t*-test	Wilcoxon	Mean	Median	*t*-test	Wilcoxon
Pre-event													
Australia (4)	[-5, 0]	−2.41	−2.40	−2.440[a]	−1.461	−0.29	−0.47	−0.249	−0.365	−17.84	−14.57	−2.836[a]	−1.826[a]
Canada (5)	[-5, 0]	0.97	−0.10	0.617	−0.405	−3.41	−2.77	−1.366	−1.214	−4.63	−6.23	−1.947	−1.483
China (8)	[-5, 0]	0.99	−0.10	1.109	−0.560	1.64	0.25	0.883	0.280	7.07	6.15	4.393[c]	2.521[b]
India (4)	[-5, 0]	8.16	2.02	1.023	1.095	2.91	1.10	1.405	1.826[a]	−2.86	−0.30	−0.892	−0.365
S. Korea (7)	[-5, 0]	−3.24	−4.23	−1.540	−1.183	−4.62	−6.07	−2.172[a]	−1.690[a]	−1.55	0.51	−0.345	−0.845
Thailand (4)	[-5, 0]	−2.74	−3.01	−2.782[a]	−1.826[a]	−5.76	−5.63	−3.073[a]	−1.826[a]	5.57	7.38	0.740	0.730
U.K. (5)	[-5, 0]	2.29	6.01	0.589	0.674	1.22	0.10	1.193	0.674	−2.52	−1.40	−1.099	−1.214
U.S. (13)	[-5, 0]	−3.29	−1.89	−1.776	−3.040[c]	−3.12	−3.45	−6.436[c]	−3.180[c]	−0.54	−2.50	−0.179	−0.524
On-event													
Australia (4)	[0, 0]	0.67	0.38	1.553	1.826[a]	0.26	0.34	0.273	0.730	−4.20	−4.83	−4.172[b]	−1.826[a]
Canada (5)	[0, 0]	0.53	0.48	1.472	1.214	−1.38	−0.52	−1.628	−2.023[b]	−3.77	−4.36	−3.143[b]	−2.023[b]
China (8)	[0, 0]	−0.13	−0.40	−0.263	−0.700	−1.15	−1.66	−1.863	−1.540	3.59	2.63	3.533[c]	2.521[b]
India (4)	[0, 0]	0.57	0.07	0.399	0.730	0.13	0.00	0.778	0.365	−3.06	−3.99	−2.938[a]	−1.461
S. Korea (7)	[0, 0]	−0.50	−0.70	−0.874	−1.014	−0.13	−0.36	−0.171	−0.338	−0.20	0.95	−0.175	−0.676
Thailand (4)	[0, 0]	1.48	0.95	1.921	1.826[a]	−1.14	−1.31	−0.94	−1.095	−0.10	0.13	−0.073	−0.365
U.K. (5)	[0, 0]	−2.77	−0.85	−0.856	−0.944	−0.34	−0.33	−0.791	−0.405	−1.65	−0.32	−0.717	−0.674
U.S. (13)	[0, 0]	−0.91	−0.69	−2.658[b]	−2.621[c]	0.38	0.25	1.254	1.013	−1.45	−0.72	−1.303	−1.013
Post-event													
Australia (4)	[0,+5]	−0.48	−1.96	−0.263	−0.365	−8.78	−6.27	−2.089	−1.826[a]	−25.10	−28.87	−3.441[b]	−1.826[a]
Canada (5)	[0,+5]	0.05	−0.12	0.040	−0.674	−5.66	−5.79	−2.215[a]	−2.023[b]	−36.89	−49.95	−3.311[b]	−2.023[b]
China (8)	[0,+5]	−2.75	−4.76	−1.545	−1.120	−2.86	−3.60	−1.323	−1.400	−2.79	−2.36	−1.544	−1.400
India (4)	[0,+5]	0.57	1.73	0.319	0.365	−0.86	−0.93	−0.337	−0.365	−6.71	−5.44	−0.870	−1.095
S. Korea (7)	[0,+5]	−2.38	−3.95	−2.108[a]	−1.690[a]	5.31	3.62	0.957	0.676	−8.24	−3.15	−1.947[a]	−1.690[a]
Thailand (4)	[0,+5]	1.56	1.65	1.990	1.461	−14.44	−9.96	−2.339	−1.826[a]	−8.13	−8.41	−6.148[c]	−1.826[a]
U.K. (5)	[0,+5]	−4.03	−4.47	−1.668	−1.483	−14.68	−18.55	−2.047	−1.483	−53.73	−54.51	−2.786[b]	−1.753[a]
U.S. (13)	[0,+5]	−3.27	1.07	−0.706	1.153	−10.62	−10.69	−8.436[c]	−3.180[c]	−32.42	−38.53	−3.285[c]	−2.411[b]

The numbers shown in the parentheses are the number of airline firms.
[a] Statistical significance at the 10% level.
[b] Statistical significance at the 5% level.
[c] Statistical significance at the 1% level.

- Canada and the United States.

- Canada and China.
- India and the United Kingdom.
- United States and China.
- Australia and China.

QUESTION

From the text below extracted from the article of Rokicki *et al.* (2020), "Changes in Logistics Activities in Poland as a Result of the COVID-19 Pandemic", the identification of changes in individual segments of logistics activities was anchored in:

"*The first stage of the research presented the situation in Poland before and during the COVID-19 pandemic (2015–2021) in terms of the top logistics companies' revenues. Such data made it possible to identify changes in logistics activities. These changes can happen because the top companies set the direction of change and provide a barometer of the situation in the industry. For this purpose, chained and fixed-base dynamic indicators were used. The coefficients of variation were used to show the variability in individual periods. The analyses presented were supplemented by listing the top 10 companies in revenue dynamics in the years in question. In this case, it was possible to identify changes based on the fastest-growing companies. This also made it possible to compare the situation and growth opportunities before COVID-19 and during the pandemic. In addition, it was determined which logistics business segments developed best in the different periods. This section aimed to show the directions of change and the actual leaders in the logistics business in Poland in the period before and during the pandemic.*"

- Multicriteria methods.
- benefit-cost analysis.
- Delphi methods.
- Fixed-base dynamics indicators.
- Analysis of the life cycle of logistics activities.

QUESTION

The paper of Marrekchi *et al.* (2021), "A review of recent advances in the operations research literature on the green routing problem and its variant", presents in Table 3 below the different Fuel Consumption (FC) factors defined in the literature for the vehicle, traffic, driver and the roadway, for instance.

Table 3 Literature on minimum emissions path problem

References	TP		TO		OF		V		C			SP	SP-DV	LO	LO-DV
	DET	STO	P/D	PD	Mo	Mu	HO	HE	TW	TD	DRI				
Qian and Eglese (2014)	√		√		√		√		√				√		
Ehmke et al. (2016)	√		√		√		√			√		√			
Koc et al. (2016)	√		√		√			√				√			√
Qian and Eglese (2016)	√		√		√		√		√				√		
Hosseini-Nassab & Lotfalian (2017)	√		√			√	√					√			√
Liu et al. (2017)	√		√		√			√	√		√	√			√

Let us say that one has mentioned the following sentences:

I. Some of the main FC factors for the vehicle are: driver behavior, aggressiveness, distance and time.
II. Some of the main FC factors for the traffic are: grade, curvature, engine size, distance.
III. Some of the main FC factors for the operations are: distance, time, speed and deceleration.
IV. Some of the main FC factors for the vehicle are: altitude, roadway gradient, pavement type and

aggressiveness.

V. Some of the main FC factors for the driver are: driver behavior, aggressiveness, gear selection and idle time.

Select the right sentence below according to the Table 3:

- Only item I is correct.
- Only item II is correct.
- Only item III is correct.
- Only item IV is correct.
- Only item V is correct.

QUESTION

According to results presented in Table 5 below, extracted from the paper of Faber *et al.* (2021), "The role of travel-related reasons for location choice in residential self-selection", the wrong statement is:

Table 5
Standardized direct and total effects of the cross-sectional model.

Dependent Variables																			
Independent variables	Built Environment				Attitudes			Reasons				Car use		Train Use		BTM Use		Bicycle Use	
	Density	Distance Centrality	Distance M/T	Distance Bus	Car	PT	Bike	Car	PT	Bike Work	Bike Shop	Direct Effect	Total Effect	Direct Effect	Total Effect	Direct Effect	Total Effect	Direct Effect	Total Effect
Socio-Demographics																			
Western ethnicity	−0.056	0.031		0.040		−0.039		−0.060	−0.072		−0.040		0.020		−0.035		−0.047	0.030	0.037
Gender (Male)				0.043	0.071						−0.069		0.013		−0.001	−0.025	−0.028	−0.042	−0.057
Age	−0.075	0.051	0.048	−0.051	−0.102	0.063	0.051		−0.084	−0.047		0.081	0.083	−0.281	−0.250	−0.243	−0.250	−0.070	−0.028
High Education	0.064	−0.096			−0.098	0.035	0.091	0.065	0.096		0.060		−0.065	0.133	0.198	0.080	0.141	0.046	0.100
Employment				−0.050	0.051	−0.123			−0.142	−0.065	−0.057	0.106	0.184	−0.088	−0.192	−0.101	−0.205	−0.054	−0.061
Children in hh		0.028		−0.047		−0.084		0.047	−0.120	−0.036		0.025	0.091	−0.102	−0.194	−0.084	−0.178		0.003
Income (None)	−0.045	0.053						0.036				−0.045	−0.031		−0.009		−0.012	0.032	0.030
Income (Medium)				−0.057	0.059			0.046		−0.023		0.041	0.068	0.040	0.025	0.032	0.028	−0.040	−0.053
Income (High)				−0.077	0.081			0.076				0.049	0.089	0.072	0.048	0.050	0.039		−0.015
Built Environment																			
Density												−0.125	−0.125			0.051	0.051		
Distance Centr.														−0.075	−0.075	−0.085	−0.085		
Distance M/T																−0.042	−0.042	−0.044	−0.044
Distance Bus																−0.130	−0.130		
Attitudes																			
Car Attitude	−0.034			0.036				0.046	−0.144	−0.132	−0.056	0.205	0.23	−0.111	−0.165	−0.047	−0.110	−0.131	−0.140
PT Attitude				0.029					0.216	0.035	0.027	−0.033	−0.112	0.255	0.350	0.294	0.392	0.028	0.013
Bike Attitude	0.030								0.036	0.150	0.111	−0.111	−0.124	0.056	0.042	−0.033	−0.047	0.511	0.534
Reasons																			
Car Reasons	−0.161			0.062								0.213	0.233	−0.152	−0.152	−0.140	−0.062	−0.045	−0.045
PT Reasons	0.341	−0.203		−0.339								−0.326	−0.369	0.457	0.472	0.430	0.339	−0.096	−0.096
Bike Work	−0.073			0.141								−0.049	−0.040	−0.095	−0.095	−0.088	−0.110	0.133	0.133
Bike Shop	0.113		−0.093	0.074								0.102	0.088	−0.155	−0.155	−0.153	−0.074	0.059	0.063

- Car use is affected by income.
- Built environment have a huge effect on bicycle use.
- Car attitude has a negative effect on car use.
- Bike to shop has a positive effect on car use.
- Bike to work has a positive effect on bike use.

QUESTION

According to Figure 4 extracted from Vaddadi et al. (2020), "Measuring System-Level Impacts of Corporate Mobility as a Service (CMaaS) Based on Empirical Evidence", the KPIs (key performance indicators) chosen to evaluate impacts on Societal Level are:

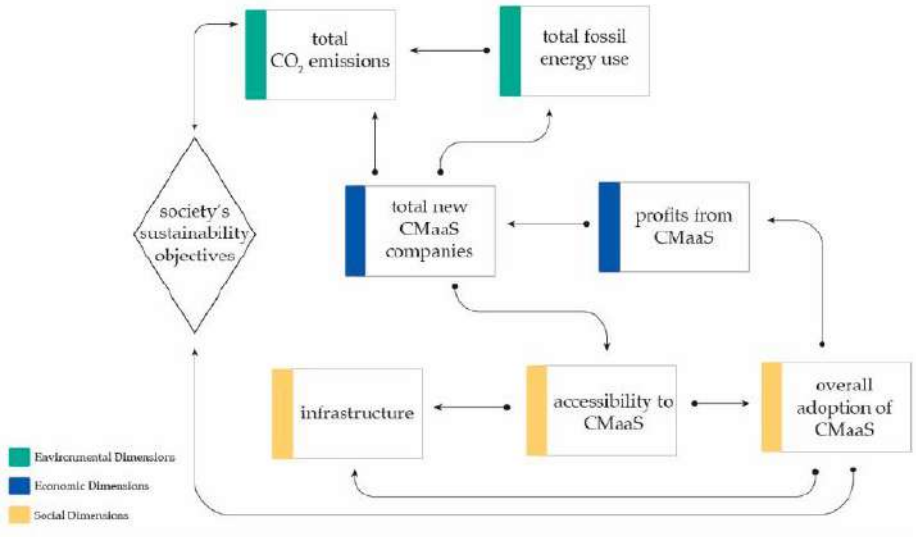

Figure 4. Interactions among environmental, economic, and social dimensions on the societal level.

- Energy use & Emissions, Business Models, Quality of Travel.
- Infrastructure & Land Use, Accessibility, Quality of Travel.
- Energy use & Emissions, Business Models, Employment, Infrastructure & Land Use, Accessibility, Quality of Travel.
- Energy use & Emissions, Business Models, Employment.
- None of the above.

QUESTION

The paper of Medury and Grembek (2016) presents a comparison between an implementation of the sliding window method and dynamic programming wherein the underlying algorithms seek to partition the road network into non-overlapping hot spots. In order to quantify the differences between the sliding window method and dynamic programming, Table 2 provides some statistics with regards to the average number of crashes per hot spot and the average length of the hot spots for the two moving window approaches. It is important to note that the average hot spot length in Table 2(a) corresponds to a trimmed hot spot, which implies that the hot spot is trimmed at the end, so as to have the end point coincide with a crash.

Table 2
Additional summary statistics.

(a) Sliding window

Minimum number of crashes per hot spot, n_{min}	Fixed hot spot window length, w					
	0.025 miles		0.05 miles		0.1 miles	
	Average number of crashes per hot spot	Average *trimmed* hot spot length (in miles)	Average number of crashes per hot spot	Average *trimmed* hot spot length (in miles)	Average number of crashes per hot spot	Average *trimmed* hot spot length (in miles)
2	2.515	0.009	2.577	0.020	2.730	0.045
3	3.625	0.012	3.720	0.024	3.900	0.056
4	4.514	0.014	4.735	0.027	5.105	0.063
5	5.509	0.015	5.756	0.029	6.092	0.069
6	6.600	0.017	6.909	0.032	7.329	0.077
7	7.300	0.017	8.000	0.033	7.980	0.081
8	8.500	0.015	8.875	0.039	9.080	0.086
9	9.000	0.020	10.333	0.047	10.077	0.087

(b) Dynamic programming

Minimum number of crashes per hot spot, n_{min}	Maximum hot spot window length, w					
	0.025 miles		0.05 miles		0.1 miles	
	Average number of crashes per hot spot	Average hot spot length (in miles)	Average number of crashes per hot spot	Average hot spot length (in miles)	Average number of crashes per hot spot	Average hot spot length (in miles)
2	2.187	0.008	2.194	0.016	2.179	0.035
3	3.431	0.012	3.427	0.022	3.347	0.049
4	4.430	0.014	4.538	0.025	4.586	0.057
5	5.585	0.015	5.570	0.028	5.718	0.068
6	6.650	0.017	6.794	0.033	7.013	0.074
7	7.300	0.017	8.000	0.033	7.827	0.080
8	8.500	0.015	8.875	0.039	9.160	0.085
9	9.000	0.020	10.333	0.047	10.231	0.087

Based on the Table 2 above, it is correct to say that:

I. By comparing the lengths of the trimmed sliding window hot spots with the fixed hot spot lengths (w), it can be observed that a large fraction of the fixed hot spot length goes unutilized in the sliding window method.
II. The lengths of the trimmed sliding window hot spots are always smaller than the average hot spot lengths of the dynamic programming.
III. The dynamic programming framework produces smaller hot spot lengths, even when compared to the trimmed window lengths of the sliding window method. This impacts the average number of crashes per hot spot, wherein the sliding window approach performs better than dynamic programming.

In relation to the statements above, choose the correct answer:

- All statements are correct.
- Only statement I is correct.
- Only statement II is correct.
- Only statements I and III are correct.
- Only statements II and III are correct.