

Rational Decision Making

DSC2602

Semesters 1 and 2

Department of Decision Sciences

Important Information

Please register on myUnisa, activate your myLife e-mail addresses and make sure that you have regular access to the myUnisa module website, DSC2602-2018 S1/S2.

Note: This is an online module and therefore it is available on myUnisa. However, in order to support you in your learning process, you will also receive some study material in printed format.

Bar code

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1 INTRODUCTION AND WELCOME

Dear Student

It is a pleasure to welcome you as a student in this module, Rational Decision Making (DSC2602). We hope you will enjoy this module and complete it successfully. We shall do our best to help you make your study for this module successful. You will be well on your way to success if you start studying early in the semester and resolve to do all the assignments on time.

It is essential that you read this tutorial letter (Tutorial Letter 101 for 2018) very carefully since it contains important information about this particular module.

Because this is a fully online module, you will need to use myUnisa to study and complete the learning activities for this course. Visit the website for DSC2602 on myUnisa frequently. The website for your module is DSC2602-18-S1 (Semester 1) or DSC2602-18-S2 (Semester 2).

1.1 Getting started

Owing to the nature of this module, you can read about the module and find your study material online. Go to the website at <https://my.unisa.ac.za> and log in using your student number and password. You will see DSC2602-18-S1 or DSC2602-18-S2 in the row of modules displayed in the orange blocks at the top of the webpage. Select the **More** tab if you cannot find the module you require in the orange blocks. Then click on the module you want to open.

You will receive this tutorial letter and a printed copy of the online study material for your module. While the printed material may appear different from the online study material, it is the same, as it has been copied from the myUnisa website. We wish you much success in your studies!

2 OVERVIEW OF DSC2602

2.1 Purpose

Students, who have completed this module successfully, will be able to use data analysis techniques to manipulate and process data into meaningful information, apply data analysis techniques to solve operations research problems in statistical quality management and solve operations research problems from selected topics in operations research, which include decision analysis, project management and network modelling.

2.2 Outcomes

The learning outcomes for this module are as follows:

- **Specific outcome 1:** Students are able to use descriptive statistics and calculate probabilities for distributions and estimation of parameters.

- **Specific outcome 2:** Students are able to use techniques used in quality management which include statistical process control, acceptance sampling and process capability.
- **Specific outcome 3:** Students are able to apply decision analysis by constructing payoff tables and decision trees, making decisions with and without probabilities, applying marginal analysis and using utilities.
- **Specific outcome 4:** Students are able to model project management using network diagrams, doing project scheduling with uncertain activity durations and crashing activity durations.
- **Specific outcome 5:** Students are able to use network models to solve shortest route problems, minimum spanning tree problems and maximum flow problems in areas such as transportation systems design, information systems design and project scheduling.

The above is covered in the study guide, chapters 1 to 8. Learning outcomes and assessment criteria for this module can be found on myUnisa under **Additional Resources**.

3 LECTURERS AND CONTACT DETAILS

3.1 Lecturers

Write down your lecturer's information in the following box:

Your lecturer will assist you with any problems you may have with the study material (not administrative matters). You are welcome to contact him/her by means of post, e-mail, telephone or a personal visit. If you want to visit the lecturer personally, please phone well in advance to make an appointment.

3.2 Department

You can contact the Department of Decision Sciences as follows:

Tel: +27 12 433 4684

E-mail: qm@unisa.ac.za

3.3 University

To contact the University follow the instructions in the brochure **Study @ Unisa**. Remember to have your student number available whenever you contact the University. Whenever you write to a lecturer, please include your student number to enable the lecturer to help you more effectively.

4 RESOURCES

4.1 Joining myUnisa

If you have access to a computer that is linked to the internet, you can quickly access resources and information at the University. The myUnisa learning management system is the University's online campus that will help you communicate with your lecturers, with other students and with the administrative departments at Unisa all through the computer and the internet.

You can start at the main Unisa website at <http://www.unisa.ac.za> and then click on the myUnisa orange block. This will take you to the myUnisa website. To go to the myUnisa website directly, go to <https://my.unisa.ac.za>. Click on the **Claim UNISA Login** on the right-hand side of the screen on the myUnisa website. You will then be prompted to give your student number in order to claim your initial myUnisa details as well as your myLife e-mail login details.

For more information on myUnisa, consult the brochure **Study @ Unisa**, which you received with your study material.

The following are important tools on myUnisa that you will use regularly:

- *Announcements*
Announcements will be posted on myUnisa whenever necessary. If your myLife email address has been set up, you will also receive the announcements via e-mail.
- *Discussions*
Module-related problems and possible solutions are shared on this platform by students.
- *Assignments*
All assignments must be submitted through myUnisa as pdf files.

4.2 Other resources **printed support material**

Because we want you to be successful in this online module, we also provide you with some of the study material in printed format. This will allow you to read the study material even if you are not online.

The printed study material will be sent to you at the beginning of the semester, but you do not have to wait for it before you start studying you can go online as soon as you have registered and find all your study material there. The material we will send you is an **offline** copy of the formal content for the online module.

It is very important that you log in to myUnisa regularly. We recommend that you log in at least once a week or every 10 days to do the following:

- **Check for new announcements.** You can also set your myLife e-mail account to receive the announcement e-mails on your cellphone.
- **Do the Activities at the end of each chapter.** When you do the activities for each unit, we want you to share your answers with the other people in your group. You can read the instructions and even prepare your answers offline, but you will need to go online to post your messages.

We hope that by giving you extra ways to study the material and practise all of the activities, this system will help you succeed in the online module. To get the most out of the online course you **MUST** go online regularly to complete the activities and assignments on time.

Remember, the printed support material is back-up material for everything that is found online on myUnisa. It does not contain any extra information. **In other words, do NOT wait for the printed support material to arrive before you start studying.**

5 HOW TO STUDY ONLINE

5.1 What does it mean to study fully online?

Studying fully online modules differs completely from studying some of your other modules at Unisa.

- **All your study material and learning activities for online modules are designed to be delivered online on myUnisa.** Although we give you a printed copy to support your studies, the module is designed to be delivered online.
- All of your assignments must be submitted online. This means that you do all your activities and submit all your assignments on myUnisa.
- All of the communication between you and the University happens online. Lecturers will communicate to you by e-mail, and using the **Announcements**, and sometimes **Discussion Forums**. You can also use all of these ways to ask questions and contact your lecturers.

6 MODULE-SPECIFIC STUDY PLAN

Our semesters are quite short, only ± 15 weeks. You are required to work through the study material and complete it and prepare for examinations within this short period. For you to be able to work through the study material you must plan your time carefully. You must work consistently from the first day until the last day. Make sure you have at least 45 minutes everyday to spend on this module. To help you plan your study time, we have divided your study material into sections. You must complete each section together with the relevant study material within a week. If you follow the schedule in the following table you will successfully complete all the assignments on time and fully prepare for the examination

Work covered	Study time	Self-evaluation exercise
Chapter 1	Week 1	1
Chapter 2	Week 2	2
Chapter 3 up to section 3.3	Week 3	3
COMPLETE COMPULSORY ASSIGNMENT 01		
Chapter 3, section 3.4 up to section 3.7	Week 4	3
Chapter 4	Week 5	4
Chapter 5	Week 6	5
COMPLETE COMPULSORY ASSIGNMENT 02		
Chapter 6	Week 7	6
Chapter 7	Week 8	7
Chapter 8	Week 9	8
COMPLETE COMPULSORY ASSIGNMENT 03		
REVISION		

NOTE: For this module Week 1 for the two semesters start on the following dates:

- Semester 1 week 1 starts on 29 January 2018 .
- Semester 2 week 1 starts on 16 July 2018 .

7 ASSESSMENT

7.1 Assessment plan

Assessment of your understanding and sound knowledge of the contents of this module will be through completion of three assignments (two written assignments and one multiple-choice assignment) as well as a written two-hour examination.

Students must submit assignments electronically via myUnisa. Assignments may not be submitted by fax or e-mail.

For detailed information on assignments, please consult myUnisa. To submit an assignment via myUnisa:

- Go to myUnisa (<https://my.unisa.ac.za/>) .
- Log in using your student number and password.
- Select the module.
- Click on “Assessment Info” in the menu on the left-hand side of the screen.
- Click on the assignment number you want to submit.
- Follow the instructions.

Since Assignments 01 and 02 are written assignments, you need to complete them in an electronic document to be able to submit them electronically. Most of you will probably have access to Microsoft

word 2010. Use the Equation Editor for the mathematical formulas. To use the Equation Editor in a 2010 Microsoft word document, click on **Insert** (on the main menu bar), and on **Equation**.

We encourage you to submit all assignments to Unisa on or before the due dates so that the lecturer will be able to mark and return them to you. The main objective of the assignments is to give you the opportunity to receive feedback on your answers from the lecturer. Note that assignments that are submitted after the due date will not be marked. Solutions to the assignments will be available on myUnisa under **Additional Resources** after the due date.

In addition to noting the feedback from the lecturer, you should use the model solutions to evaluate your answers in detail and to see how answers should be set out.

Please note that neither the Department of Decision Sciences nor the School of Economic Sciences will be able to confirm whether or not the University has received your assignment. If you have any queries about whether your assignment has been received, registered, processed or returned, please send an email with your student number in the subject heading to assign@unisa.ac.za (Assignment administration section) enquiring about your assignment or consult myUnisa (<https://my.unisa.ac.za/>).

7.2 General assignment numbers

Assignments are numbered consecutively per module, starting from 01. There are three assignments to be submitted during each semester. Assignments 01 and 02 are written assignments. Assignment 03 contains multiple-choice questions that must be completed on myUnisa.

You must submit all assignments. Assignment 01 contributes 20% to your semester mark for the module. Assignment 02 contributes 50% towards your semester mark. Assignment 03 contributes 30% to your semester mark. The semester mark contributes 20% to your final mark. Assignment due dates and unique numbers are shown in the following table:

7.2.1 Unique assignment numbers and due dates

Semester	Assignment	Type	Due date	Unique number
1	Assignment 01	Written	26 February 2018	742799
	Assignment 02	Written	19 March 2018	879353
	Assignment 03	Multiple-choice	9 April 2018	777679
2	Assignment 01	Written	13 August 2018	757903
	Assignment 02	Written	27 August 2018	754277
	Assignment 03	Multiple-choice	10 September 2018	705632

7.3 Assignments: First semester

FOR SEMESTER 1 STUDENTS ONLY

ASSIGNMENT 01

Unique number: **742799**

Fixed due date: **26 February 2018**

NOTE

- **Assignment 01 is compulsory and it must reach Unisa before the due date.** No late assignments will be marked.
- The unique number of this compulsory assignment is very important.
- **Study material:** Chapter 1, Chapter 2 and Chapter 3 (section 3.1 up to and including section 3.3).
- This assignment is a **written assignment**. Submit your assignment electronically via myUnisa.
- Show ALL your calculations in full.

Question 1

The number of new orders received by a company over the past 25 working days has been recorded and tabulated as follows:

3	0	1	4	4
4	2	5	3	6
4	5	1	4	2
3	0	2	0	5
4	2	3	3	1

- 1.1 Determine the mode of the data. (1)
- 1.2 Determine the median of the data. (2)
- 1.3 Calculate the sample mean of the data set. (2)
- 1.4 Calculate the standard deviation of the data set. (2)
- 1.5 Calculate the coefficient of variation of the data set. (2)
- 1.6 Calculate the range of the data set. (2)

[11]

Question 2

Consider a population of 2 000 individuals, 800 of whom are married. Assume that 300 of the people who are married have children and that 200 of the unmarried people have children.

- 2.1 What is the probability that an individual has no children? (2)
- 2.2 What is the probability that a randomly selected individual is unmarried if we know that he or she has children? (3)
- [5]

Question 3

A survey of 150 residents from a small resort town was taken to determine their attitude towards a proposed hotel development. The following results display the occupation of the residents and indicate whether they approved of building the hotel, or not:

	Building and trade	Businessmen	Other
Approve	40	40	5
Disapprove	10	20	35

- 3.1 What is the probability that a randomly selected resident will approve of building the hotel? (1)
- 3.2 If a resident is selected randomly, what is the probability that the selected resident will be a businessmen and will disapprove of building the hotel? (2)
- 3.3 What is the probability that a randomly selected resident will approve of building of the hotel given that the resident is in building and trade? (2)
- 3.4 Are the events “businessmen” and “approve” independent? Explain your answer. (2)
- [7]

Question 4

The probability distribution for x , the sum of two ordinary dice tossed, is as follows:

x	2	3	4	5	6	7	8	9	10	11	12
$P(x)$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

Calculate the following:

- 4.1 the mean (3)
- 4.2 the variance (3)
- 4.3 the standard deviation (1)
- [7]

[Total marks: 30]

FOR SEMESTER 1 STUDENTS ONLY
ASSIGNMENT 02

Unique number: **879353**
 Fixed due date: **19 March 2018**

NOTE:

- **Assignment 02 is compulsory and it must reach Unisa before the due date.** No late assignments will be marked.
- The unique number of this compulsory assignment is very important.
- **Study material:** Chapter 3 (section 3.4 up to and including section 3.7), Chapter 4 and Chapter 5.
- This assignment is a **written assignment**. Submit your assignment electronically via myUnisa.
- Show **ALL** your calculations in full.

Question 1

The average amount of money that a small company spends on petrol in a year is R30 000, with a standard deviation of R5 000. Assume that a normal distribution is applicable, and that no increase in the petrol price is expected during the year. What is the probability that the company will use

- 1.1 more than R31 000? (2)
- 1.2 less than R28 500? (2)
- 1.3 between R25 000 and R29 700? (4)
- [8]**

Question 2

The number of train passengers who fail to pay for their tickets in a certain region has a Poisson distribution with a mean of four passengers per train. Find the probability that

- 2.1 at most, two passengers in a train will fail to pay their tickets. (3)
- 2.2 at least three passengers in a train will fail to pay their tickets. (2)
- 2.3 If there are 4 800 trains per month in the region, find the expected number of trains with exactly two passengers per train who will fail to pay for their tickets. (2)
- [7]**

Question 3

Suppose a random number N is taken from 690 to 850 in a uniform distribution. Find the probability that

3.1 the number N will be between 710 and 800. (3)

3.2 the number N will be greater than 780. (2)

[5]

Question 4

Each question in a multiple-choice test has four possible answers, one of which is correct. If there are eight questions on the test and a student guesses each one, what is the probability that the student will

4.1 get at least six of the eight correct? (2)

4.2 get at most three of the eight correct? (2)

4.3 get exactly five of the eight **wrong**? (1)

[5]

Question 5

A farmer has recorded the number of times (x) he has fertilised the different crops on his farm and, at harvest time, records the different crops in tons (y). The results are as follows:

x	1	2	4	5	6	8	10
y	2	3	4	7	12	10	7

5.1 Calculate Pearson's correlation coefficient and interpret your answer. (2)

5.2 Fit a linear regression model to the data. (2)

5.3 Estimate the weight of the crops if the farmer fertilised the crops seven times. (2)

5.4 Determine if the fitted linear regression model in 5.2 is statistically significant at a 5% level of significance. (5)

[11]

Question 6

In a certain television series, it has been alleged that there is a negative linear correlation between income and the number of hours that a person sets aside for sleep. To investigate this statement, a random sample of people, all working for the same company, was taken.

Using Excel regression analysis, the following output was obtained:

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.563744776							
R Square	0.317808173							
Adjusted R Square	0.279908627							
Standard Error	2.389840796							
Observations	20							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	47.89266402	47.89266402	8.385540374	0.009632783			
Residual	18	102.8041025	5.711339029					
Total	19	150.6967666						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	18.78830521	4.632674428	4.055606649	0.000742025	9.055417402	28.52119303	9.055417402	28.52119303
x	-1.787478902	0.617270323	-2.895779752	0.009632783	-3.084315727	-0.490642076	-3.084315727	-0.490642076

6.1 Using the Excel printout, determine the sample size used to investigate the statement. (1)

6.2 Determine the linear regression model using the Excel printout. (2)

6.3 What is the coefficient of determination according to the printout? Interpret your answer. (2)

6.4 Is the linear regression model statistically significant for this data on the 5% level of significance? (3)

[8]

Question 7

Fifteen selling prices (in thousands of rand) of residences selected randomly from the Cape Town population of selling prices are as follows:

500 970 950 1 770 2 000 1 423 1 470 1 650
 3 200 1 650 1 689 700 1 303 9 200 1 060

7.1 Find point estimates for μ and σ . (2)

7.2 Calculate a 95% confidence interval for μ . Assume that the selling prices are normally distributed. (4)

[6]

[Total marks: 50]

<p>FOR SEMESTER 1 STUDENTS ONLY</p>
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<p>ASSIGNMENT 03</p>

<p>Unique number: 777679</p>

<p>Fixed due date: 9 April 2018</p>
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NOTE:

- **Assignment 03 is compulsory and it must reach Unisa before the due date.** No late assignments will be marked.
- This assignment contains multiple-choice questions. Complete the **online mark-reading** sheet on myUnisa and submit it online via myUnisa.
- The unique number of this compulsory assignment is very important.
- **Assignment 03 consists of 15 questions.**
- **Study material:** Chapter 6, Chapter 7 and Chapter 8.
- **Choose the correct option for each question. Only one of the options is correct.**

Question 1

Several criteria exist for making decisions under conditions of uncertainty. The criterion that selects the decision alternative that maximises the minimum payoff is called

- [1] maximax criterion.
- [2] maximin criterion.
- [3] minimax regret criterion.
- [4] expected value approach criterion.
- [5] None of the options listed above.

Questions 2 to 5 are based on the following information:

A sweets company has three decision alternatives to use for its logo in anticipation of higher demands. The probability of a high level of demand is 0,2, of a medium level of demand is 0,5 and of a low level of demand is 0,3. The rand yields of the company under the different conditions are summarised in the following table:

Decision alternatives	Demand		
	High	Medium	Low
Alternative 1	80 000	60 000	-15 000
Alternative 2	60 000	50 000	10 000
Alternative 3	0	0	0

Question 2

Find the best decision alternative using the optimistic approach:

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] Alternatives 1 and 2
- [5] None of the above

Question 3

Find the best decision alternative using the conservative approach:

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] Alternatives 1 and 2
- [5] None of the above

Question 4

What would the company's decision be if it used the minimax regret approach?

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] Alternatives 1 and 2
- [5] None of the above

Question 5

If perfect information about the demand is available, what is the maximum that the company should pay to acquire the information?

- [1] R41 500
- [2] R49 000
- [3] R9 000
- [4] R7 500
- [5] None of the above

Question 6

Consider the following payoff table:

Decision alternatives	States of nature	
	A	B
Alternative 1	500	600
Alternative 2	300	900

Using sensitivity analysis, it can be stated that Alternative 2 will remain the best alternative as long as the probability of A is at most

- [1] 0,33.
- [2] 0,60.
- [3] 0,40.
- [4] 0,50.
- [5] None of the above

Question 7

Managers use the network analysis of PERT and CPM to help them

- [1] derive flexibility by identifying noncritical activities.
- [2] replan, reschedule, and reallocate resources such as manpower and finances.
- [3] plan, schedule, monitor, and control large and complex projects.
- [4] All of the above
- [5] None of the above

Questions 8 to 11 are based on the following information:

Building a backyard swimming pool consists of nine major activities. The activities, their immediate predecessors and the activity time estimates (in days) are shown in the following table:

Activity	Immediate predecessor(s)	Time (days)		
		a Optimistic	m Most probable	b Pessimistic
A	-	3	5	6
B	-	2	4	6
C	A, B	5	6	7
D	A, B	7	9	10
E	B	2	4	6
F	C	1	2	3
G	D	5	8	10
H	D, F	6	8	10
I	E, G, H	3	4	5

Question 8

What is the expected duration of Activity D?

- [1] 7,00
- [2] 9,00
- [3] 8,83
- [4] 10,0
- [5] 7,83

Question 9

What is the critical path of the project?

- [1] $A \rightarrow C \rightarrow F \rightarrow H \rightarrow I$
- [2] $A \rightarrow D \rightarrow G \rightarrow I$
- [3] $A \rightarrow D \rightarrow H \rightarrow I$
- [4] $B \rightarrow D \rightarrow H \rightarrow I$
- [5] None of the above

Question 10

What is the standard deviation of the project completion time, to three decimal places?

- [1] 1,027
- [2] 1,056
- [3] 1,301
- [4] 1,143
- [5] None of the above

Question 11

Assuming that the total project completion time is normally distributed, determine the probability (to four decimal places) of completing the project in fewer than 23 days.

- [1] 0,4950
- [2] 0,0480
- [3] 0,9952
- [4] 0,0048
- [5] None of the above

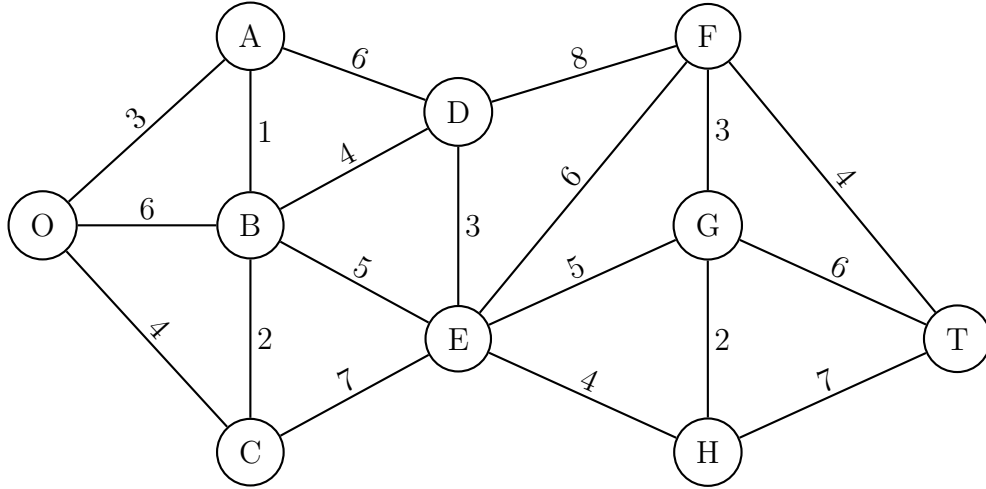
Question 12

Which of the following is not a concept associated with CPM?

- [1] normal time
- [2] probability
- [3] normal cost
- [4] crash cost
- [5] deterministic network

Question 13

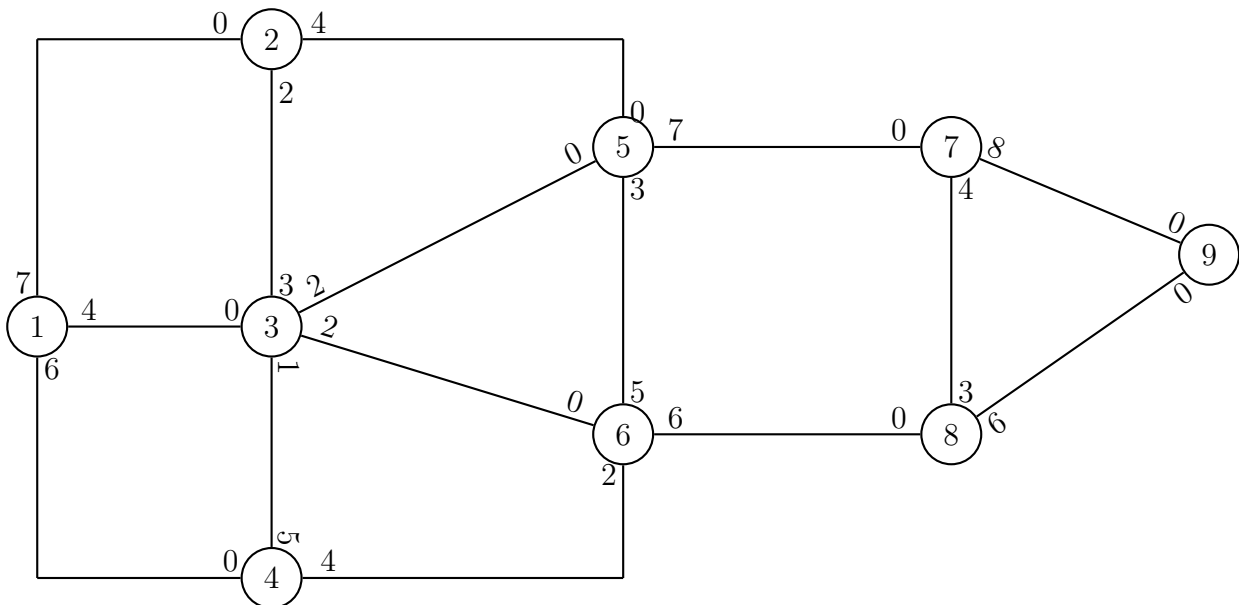
Using the shortest-route algorithm, what is the shortest route (distance in kilometres) from node O to node T in the following network diagram?



- [1] O - A - D - F - T
- [2] O - B - D - E - F - T
- [3] O - A - B - E - F - T
- [4] O - C - E - H - T
- [5] None of the above

Questions 14 and 15 are based on the following network diagram:

Use the maximum-flow algorithm in the following network diagram:



Question 14

Suppose we take route $1 - 3 - 6 - 8 - 9$ on our first iteration of the maximum-flow algorithm. What is the maximum flow that can go through this path?

- [1] 4
- [2] 3
- [3] 0
- [4] 2
- [5] 6

Question 15

What is the maximum flow of units that can flow from node 1 to node 9?

- [1] 8
- [2] 10
- [3] 12
- [4] 15
- [5] None of the above

[Total marks: 15]

7.4 Assignments: Second semester

FOR SEMESTER 2 STUDENTS ONLY**ASSIGNMENT 01**Unique number: **757903**Fixed due date: **13 August 2018****NOTE:**

- **Assignment 01 is compulsory and it must reach Unisa before the due date.** No late assignments will be marked.
- The unique number of this compulsory assignment is very important.
- **Study material:** Chapter 1, Chapter 2 and Chapter 3 (section 3.1 up to and including section 3.3).
- This assignment is a **written assignment**. Submit your assignment electronically via myUnisa.
- Show ALL your calculations in full.

Question 1

The following grouped frequency distribution table represents the cost (in rand) of a can of soup at various grocery stores:

Interval	Frequency
33 – 37	3
38 – 42	3
43 – 47	8
48 – 52	11
53 – 57	0
58 – 62	1

- 1.1 Identify the modal interval. (1)
- 1.2 Identify the median interval. (2)
- 1.3 Calculate the mean. (3)
- 1.4 Calculate the standard deviation. (5)
- 1.5 Calculate the coefficient of variation. (1)

[12]

Question 2

A company produces plastic toy elephants in two colours, blue and pink. Three machines are used to produce these toys. Machine A is used for 10% of the production, Machine B for 30% of the production and Machine C for the remainder. A production run consists in total of 500 elephants.

The production of Machine A consists of 40% blue elephants and 60% pink elephants. The production of Machine B consists of 30% blue elephants and 70% pink elephants. The production of Machine C consists of 80% pink elephants, with the remainder being blue.

2.1 What proportion of the total production do blue elephants constitute? (3)

2.2 If a particular elephant is pink, what is the probability that it was produced by Machine B? (2)

[5]

Question 3

The experiment for this question makes use of dice and a coin. Suppose two fair dice are tossed. If the sum is smaller than 10, then a fair coin will be tossed.

Note: $8T$ and 11 are elements of the sample space S (where $T = \text{tails}$).

3.1 Write down the sample space S of the experiment. (2)

3.2 Find the probability of obtaining a head. (2)

3.3 Find the probability of obtaining a head or tail. (2)

3.4 Find the probability of obtaining a sum of 8 and a tail. (2)

[8]

Question 4

The manager of a baseball team has determined the number of walks x issued in a game by one of the pitcher. This is described by the following probability distribution:

x	0	1	2	3	4
$P(x)$	$\frac{1}{20}$	$\frac{2}{20}$	$\frac{3}{20}$	$\frac{11}{20}$	$\frac{3}{20}$

4.1 Calculate the mean of the probability distribution. (2)

4.2 Calculate the variance of the probability distribution. (3)

[5]

[Total marks: 30]

FOR SEMESTER 2 STUDENTS ONLY
ASSIGNMENT 02

Unique number: **754277**
 Fixed due date: **27 August 2018**

NOTE:

- **Assignment 02 is compulsory and it must reach Unisa before the due date.** No late assignments will be marked.
- The unique number of this compulsory assignment is very important.
- **Study material:** Chapter 3 (section 3.4 up to and including section 3.7), Chapter 4 and 5.
- This assignment is a **written assignment**. Submit your assignment electronically via myUnisa.
- Show ALL your calculations in full.

Question 1

Invoices at a certain shop have amounts that follow a normal distribution, with a mean of R103,60 and a standard deviation of R8,75. What is the probability that the amount on an invoice will be

- 1.1 more than R105,65? (2)
- 1.2 less than R117,60? (3)
- 1.3 between R105,00 and R115,60? (3)
- [8]**

Question 2

On a certain road between two towns, there are, on average, 4,5 potholes per kilometre. Determine the probability that there will be

- 2.1 two potholes over a distance of one kilometre. (1)
- 2.2 at least three potholes over a distance of one kilometre. (2)
- 2.3 at most two potholes over a distance of two kilometres. (4)
- [7]**

Question 3

Inspectors on an assembly line find that an average of 1 in 10 parts is defective. The defective parts occur independently of one another.

- 3.1 What is the probability that the inspectors will find exactly eight defectives in 20 parts? (1)
- 3.2 What is the probability that the inspectors will find fewer than three defectives in 20 parts? (3)
- 3.3 What is the expected number of defective parts in a batch of 200 parts? (1)

[5]

Question 4

If X has an exponential distribution with a mean of $\lambda = 5$, determine

- 4.1 $P(X > 5)$. (3)
- 4.2 $P(X \leq 7)$. (2)

[5]

Question 5

A hospital randomly selects eight patients for a heart study. Their systolic blood pressure readings are as follows:

Patient	1	2	3	4	5	6	7	8
Blood pressure	126	110	122	98	116	124	128	144

- 5.1 Use your calculator to determine the mean and the standard deviation of the data set. (2)
- 5.2 Determine a 90% confidence interval for the mean μ . (4)

[6]

Question 6

A government official was investigating the relationship between salary (x) and the number of absences (y) of government employees. The variable y in the following table represents the average number of absences per year for employees at that salary:

Salary in thousands (x)	10,0	12,5	15,0	17,5	20,0	22,5	25,0	27,5	30,0
Number of absences (y)	2,3	2,0	2,0	1,8	2,2	1,5	1,2	1,3	0,6

- 6.1 Calculate the coefficient of determination and interpret your answer. (2)
- 6.2 Fit a linear regression model to the data. (2)
- 6.3 Estimate the average number of absences of employees earning R19 000. (2)
- 6.4 Determine if the fitted linear regression model in 6.2 is statistically significant at a 5% level of significance. (5)

[11]

Question 7

A money-lending institution wants to find out whether the number of loan applications received is influenced by the current interest rate. The manager of the institution selects eleven months with different interest rates and the number of loan applications received is recorded. The data obtained are shown in the following table:

Interest rate (x)%	8	7,5	6,5	7	9	9,5	7	7,5	8,5	9	7
Loan applications (y)	20	24	32	26	18	20	30	29	22	19	21

Using Excel regression analysis, the following output was obtained:

SUMMARY OUTPUT									
<i>Regression Statistics</i>									
Multiple R	0.781595385								
R Square	0.610891347								
Adjusted R Square	0.567657052								
Standard Error	3.181931139								
Observations	11								
ANOVA									
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>				
Regression	1	143.0596462	143.0596462	14.12978629	0.004492195				
Residual	9	91.12217195	10.12468577						
Total	10	234.1818182							
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	53.40271493	7.952667872	6.715069181	8.70317E-05	35.41253034	71.39289952	35.41253034	71.39289952	
X	-3.773755656	1.00393589	-3.7589608	0.004492195	-6.044816421	-1.502694891	-6.044816421	-1.502694891	

- 7.1 Determine the linear regression model using the Excel printout. (2)
- 7.2 What is the correlation coefficient according to the printout? (1)
- 7.3 What is the coefficient of determination according to the printout? Interpret your answer. (2)
- 7.4 Is the linear regression model statistically significant for this data on the 5% level of significance? (3)

[8]

[Total marks: 50]

FOR SEMESTER 2 STUDENTS ONLY
ASSIGNMENT 03

Unique number: **705632**
 Fixed due date: **10 September 2018**

NOTE:

- **Assignment 03 is compulsory and it must reach Unisa before the due date.** No late assignments will be marked.
- This assignment contains multiple-choice questions. Complete the **online mark-reading** sheet on myUnisa and submit it online via myUnisa.
- **Assignment 03 consists of 15 questions.**
- **Study material:** Chapter 6, Chapter 7 and Chapter 8.
- **Choose the correct option for each question. Only ONE of the options is correct.**

Question 1

It is sometimes said, "Those who gamble the most are the ones who can least afford to lose". These people gamble because

- [1] the expected monetary value is positive.
- [2] there is utility other than monetary value to consider.
- [3] the expected monetary value is negative.
- [4] the gambler has no family to consider if he or she dies.
- [5] None of the above

Questions 2 to 6 are based on the following information:

The following is a payoff table giving profits for various situations:

Alternatives	States of nature		
	A	B	C
Alternative 1	120	140	120
Alternative 2	200	100	50
Alternative 3	100	120	180
Do nothing	0	0	0
Probability	0,3	0,5	0,2

Question 2

What would be the best decision using the conservative approach?

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] Do nothing
- [5] None of the above

Question 3

What decision would an optimist make?

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] Do nothing
- [5] None of the above

Question 4

If the expected monetary value approach is used, what decision would be made?

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] Do nothing
- [5] None of the above

Question 5

If a perfect forecast of the future were available, what would be the expected value *with* this perfect information (EVwPI)?

- [1] 130
- [2] 160
- [3] 166
- [4] 36
- [5] None of the above

Question 6

If a perfect forecast of the future were available, what would be the expected value of perfect information (EVPI)?

- [1] 166
- [2] 0
- [3] 40
- [4] 36
- [5] None of the above

Questions 7 and 8 are based on the following information:

The following is an opportunity loss table:

Alternatives	States of nature		
	A	B	C
Alternative 1	0	90	85
Alternative 2	50	0	110
Alternative 3	75	80	0
Probability	0,3	0,6	0,1

Question 7

What is the expected opportunity loss of Alternative 1?

- [1] 26,0
- [2] 70,5
- [3] 62,5
- [4] 90,0
- [5] None of the above

Question 8

If a person were to use the expected opportunity loss criterion, what decision would be made?

- [1] Alternative 1
- [2] Alternative 2
- [3] Alternative 3
- [4] State of nature C
- [5] None of the above

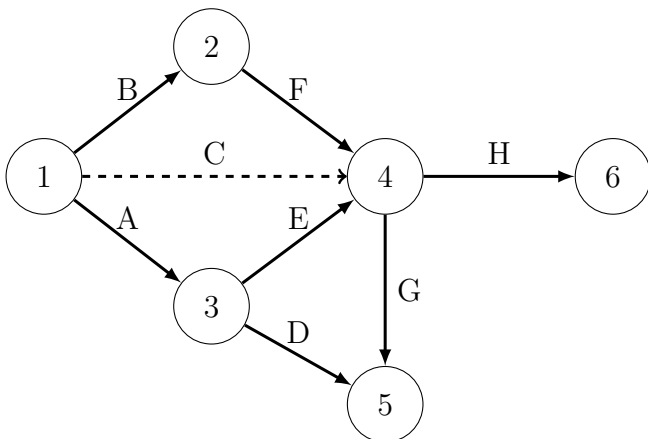
Question 9

The flight manager of World Airline has identified the following tasks and the immediate predecessor(s) of each task that should be carried out between the arrival and departure of an aeroplane:

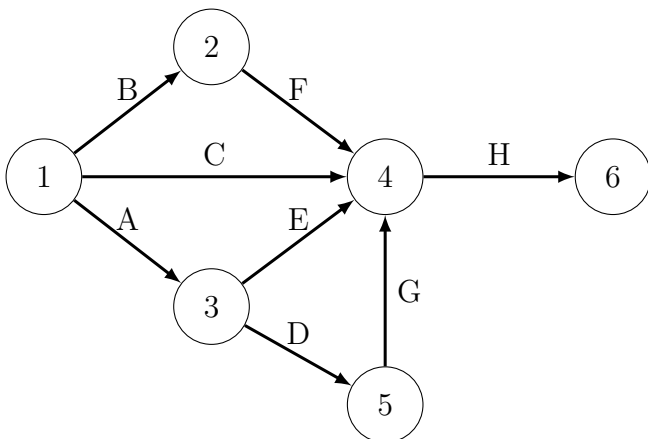
Activity	Immediate predecessor(s)
A	-
B	-
C	-
D	A
E	A
F	B
G	D
H	C, E, F, G

Which activity-on-arc network diagram represents the project?

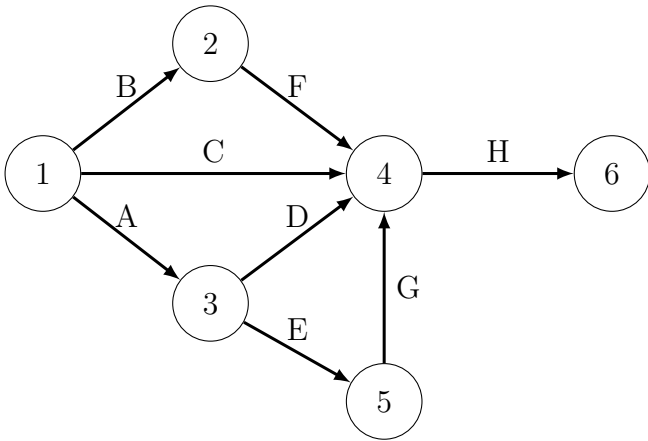
[1]



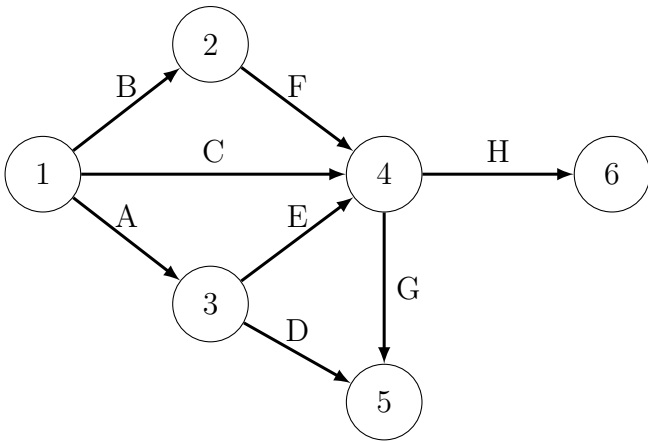
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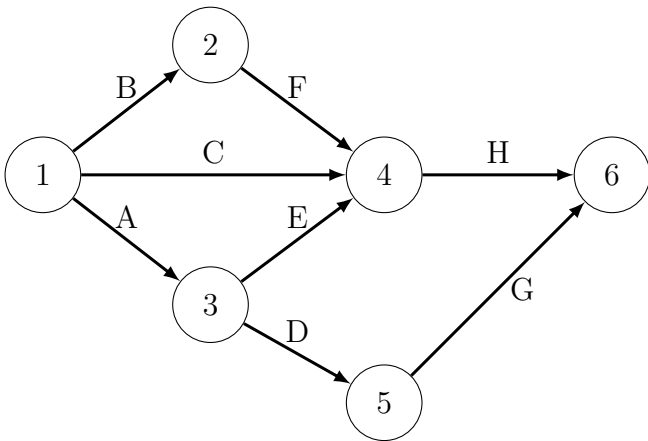
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[4]

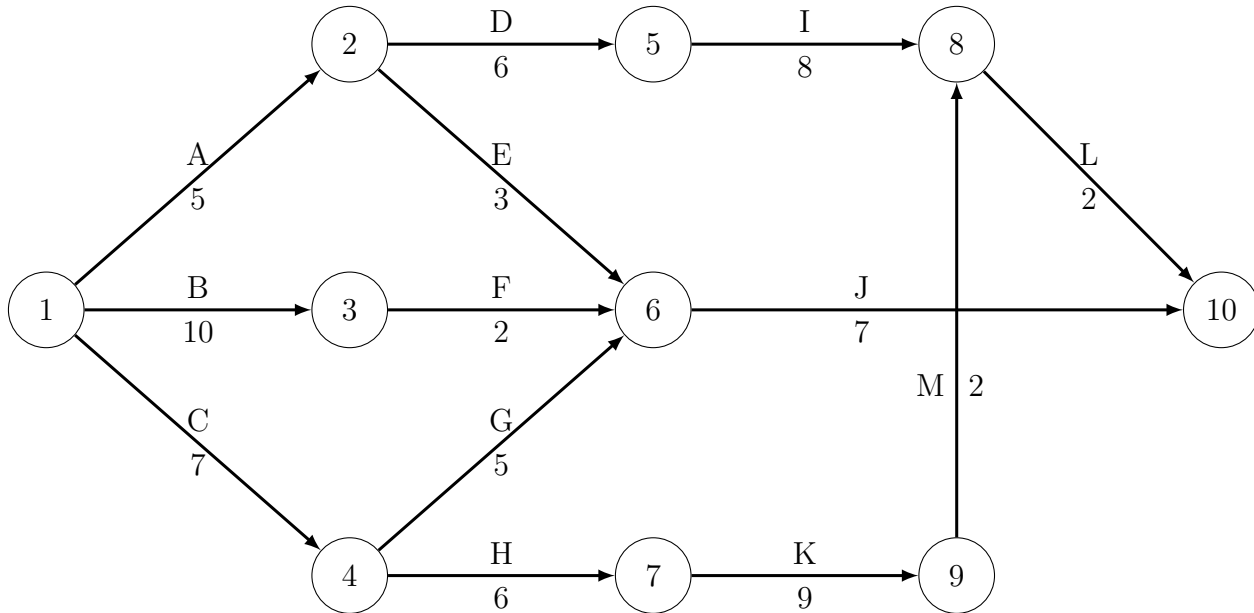


[5]



Questions 10 to 13 are based on the following information:

Consider the following project network where the activities and their durations, in days, are represented on the arcs:



Question 10

What is the critical path of the project?

- [1] A → D → I → L
- [2] C → G → J
- [3] C → H → K → M → L
- [4] B → F → J
- [5] None of the above.

Question 11

What is the minimum expected completion time of the project?

- [1] 22 days
- [2] 24 days
- [3] 19 days
- [4] 26 days
- [5] None of the above

Question 12

What is the latest possible time that activity D may be started without delaying completion of the project?

- [1] 11 days
- [2] 5 days
- [3] 10 days
- [4] 16 days
- [5] None of the above

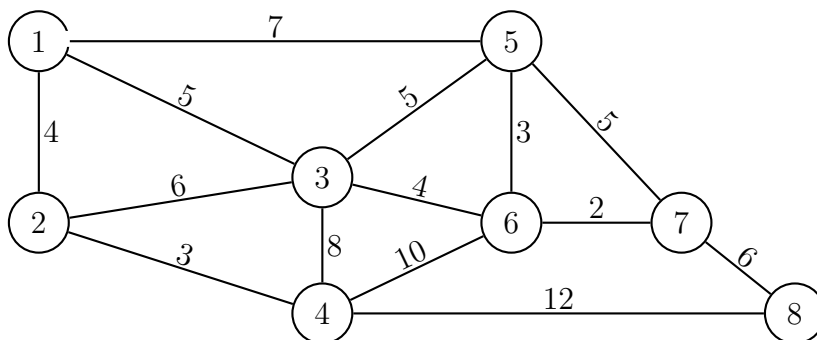
Question 13

What is the free float of activity F?

- [1] 0 days
- [2] 2 days
- [3] 7 days
- [4] 5 days
- [5] None of the above

Questions 14 and 15 are based on the following information:

One of the opposing forces in a simulated army battle wishes to set up a communication system that will connect the eight camps under its command. The following network indicates the distances in hundreds of kilometres between the camps and the different paths over which a communications line can be constructed.

**Question 14**

Suppose we arbitrarily begin the minimal spanning tree algorithm at node 3. What will be the next node to be connected?

- [1] 1
- [2] 2
- [3] 4
- [4] 5
- [5] 6

Question 15

What is the minimum distance communication system that will connect all eight camps in hundreds of kilometres?

- [1] 18
- [2] 17
- [3] 27
- [4] 30
- [5] None of the above

[Total marks: 15]

8 EXAMINATION

This module is presented in both semesters. You **must** write the examination in **May/June** if you are registered for the **first** semester, and in **October/November** if you are registered for the **second** semester.

Only writing materials and a programmable pocket calculator may be taken into the examination hall.

The duration of the examination is *two hours*.

To pass the examination you must obtain a final mark of at least 50%. The semester mark will count 20% towards the final mark if a sub-minimum of 40% is obtained in the examination.

Previous examination papers are published on myUnisa, but no memoranda will be made available to you. Old questions will not necessarily be repeated in subsequent examination papers and you are warned not to rely on old examination papers in order to pass the module.

9 CONCLUSION

I trust that you will find this module interesting and stimulating. As with any “mathematics” subject you can do no better than to start with the study material as soon as possible and to spend leisurely time with it in order to appreciate and absorb it. The most important thing is not to try to cram before assignment due dates and examinations. This will only diminish your self-confidence and creates a vicious cycle. Do not hesitate to contact us by e-mail if you are experiencing problems with the content of this tutorial letter or with any academic aspect of the module.

We wish you a fascinating and satisfying journey through the learning material and trust that you will complete the module successfully.

Enjoy the journey!

DEPARTMENT OF Decision Sciences

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