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Directorate of National Examinations

إدارة الامتحانات الوطنية

Grade 12 National Examinations

الامتحانات الوطنية للصف الثاني عشر

March 2017

امتحان مارس 2017

PROBLEM SOLVING

حل المشكلات

Paper 2 Problem Analysis and Solution

الورقة 2 تحليل وحل المشكلات

Duration: 2 hours

مدة الامتحان: ساعتان

Write your answer on the answer booklet.

اكتب الإجابة في كراسة الإجابة.

Additional materials: ruler, pencil, eraser,  
calculator, answer booklet.

الأدوات الإضافية: مسطرة، قلم رصاص، ممحاة،  
آلة حاسبة، كراسة الإجابة.

آلة حاسبة، كراسة الإجابة.

**Read these instructions first:**

Use a blue pen only.

Follow the instructions on the answer booklet  
provided.

Answer **all** questions.

The use of calculators is permitted.

The total number of marks for this paper is 50.

This document consists of **12** printed pages.

**1 Study the information below and answer the questions that follow. You should show your working.**

At the Go Comfort Shoes shop, athletic, casual and sandal shoes are sold for men, women, boys and girls. Their models and prices are listed in the following table:

	Athletic shoes		Casual shoes		Sandals	
	Model	Price (BD)	Model	Price (BD)	Model	Price (BD)
<b>Men</b>	MA1	41	MC1	25	MS1	12
	MA2	39	MC2	41	MS2	11
	MA3	34	MC3	33	MS3	14
	MA4	54	MC4	20	MS4	19
	MA5	25	MC5	27	MS5	10
<b>Women</b>	WA1	38	WC1	25	WS1	29
	WA2	27	WC2	30	WS2	15
	WA3	34	WC3	27	WS3	36
	WA4	29	WC4	34	WS4	37
	WA5	36	WC5	24	WS5	44
<b>Boys</b>	BA1	24	BC1	25	BS1	14
	BA2	31	BC2	34	BS2	17
	BA3	27	BC3	19	BS3	10
	BA4	29	BC4	30	BS4	16
	BA5	30	BC5	21	BS5	22
<b>Girls</b>	GA1	46	GC1	26	GS1	16
	GA2	30	GC2	30	GS2	14
	GA3	27	GC3	28	GS3	20
	GA4	35	GC4	18	GS4	17
	GA5	41	GC5	23	GS5	22

- (a) Ahmed and his wife took their two sons to the Go Comfort Shoes Shop.
- (a1) If everyone in the family bought a pair of casual shoes, what was the least amount they could have paid in total? [1]
- (a2) If the two parents bought athletic shoes for themselves and paid a total of BD 70, what were the possible models they selected? Give all possible combinations. [2]
- (b) A club consisting of men and women wanted to buy athletic shoes for its best 15 players. The club manager chose the models MA3 and WA2 and paid a total amount of BD 468.

What was the number of women players within the 15 best players? [2]

- (c) When Mariam and her daughter Mona visited the shop in December, the following models were reduced in a sale:

Group	Discount	Models
A	20%	BA5, MS4, WS2, GC2
B	25%	MA3, GS1, WC1
C	30%	WS4, MC2, GA5

- (c1) The shop's owner decided that the model GS4 had to be among the sale collection but his staff forgot to tag it red. If Mona chose a pair of shoes of each of the models GA3, GC2 and GS4 and her mother paid a total of BD 62.900, in which group should the GS4 model be listed? [2]
- (c2) The shop's owner decided to set a further reduction of 20% on any of the discounted models with a price more than BD 25 after discount. How much did Mariam pay for the purchase of the models WS4 and WC1? [2]

- (d) Hassan is starting a small business. He has visited the Go Comfort Shoes shop and looked at the fast moving models. He has searched the internet for the prices of these models. His search has revealed the following prices listed by the Soft Shoes Net Company:

Athletic shoes		Casual shoes		Sandals	
Model	Price (BD)	Model	Price (BD)	Model	Price (BD)
MA2	24	MC4	13	MS3	11
WA5	23	WC5	16	WS1	20
BA2	23	BC3	15	BS4	10
GA3	20	GC1	18	GS3	17

The Soft Shoes Net Company offers a shipment service. It charges BD 1.500, BD 1.200 and 700 fils per pair for an athletic model, a casual model, and a sandal model respectively. So, Hassan has ordered 3 pairs of each athletic model, 5 pairs of each casual model and 2 pairs of each sandal model.

- (d1) If Hassan sold all of the athletic shoes he purchased for a total of BD 345 and he sold all of the models WC5, BC3 and WS1 that he purchased at the prices BD 22, BD 21 and BD 27 for each pair respectively, how much would be his profit from the sale of these shoes? [3]

- (d2) Hassan has received BD 100 from a customer requesting the purchase of at least one pair of each model of sandals that he sells for the coming summer for him and his family. Hassan decided that the price of the WS1 model must be BD 5 more than the price of the GS3 model and the price of BS4 model not less than the price of MS3 model. He also wants to set his prices to be multiples of BD 1 and between the prices of the Go Comfort Shop and the prices of the Soft Shoes Net Company but **not** equal to either price. For example, he could sell the following for exactly BD 100:

Model	Price (BD)	Quantity
MS3	12	1
WS1	24	1
BS4	13	2
GS3	19	2

List three other possible cases through which Hassan can charge exactly BD 100, showing the price and the quantity of each model. [3]

**2 Study the information below and answer the questions that follow. You should show your working.**

“Al Watan” Institute offers monthly enhancement courses to school and university students. A period is set for registration at the beginning of the month, and courses start after the end of the registration period. Course fees per student depend on the number of enrolled students in this course. The table below shows details of the courses offered by the institute.

Level	Number of classrooms	Maximum number of students per classroom	Number of weekly courses per classroom	Course fees per student (BD)		
				1 – 5 students enrolled in the course	6 – 10 students enrolled in the course	Over 10 students enrolled in the course
School	14	20	6	9	8	5
University	8	16	4	12	10	6

Each course is delivered throughout the month at the rate of one day per week and in the same classroom. Students are registered individually regardless of the number of previously registered students. Excess amounts are returned to students as per their total number at the beginning of the course. The institute’s revenue is calculated after returning the excess amounts to students. For example: a university student registering for a course will always pay BD 12 upon registration and if, at the beginning of the course, the number of students in the course reaches 8, BD 2 will be returned to each student registered for the same course.

- (a) A group of 8 school students want to register for a course in the institute. What is the total amount due for payment by the group on the registration day? [1]
- (b) An employee of the institute finds out that he has accidentally registered a group of students for the wrong level. The total amount he should have received from all the registered students, according to the registers, is BD 657, whereas the actual total amount he has received is BD 639. How many students has he registered incorrectly? [2]

- (c) Approaching the end of the first semester, the maximum number of students in all the institute's classrooms and courses was reached. What is the total amount to be returned to students after the end of the registration period for this month? [3]
- (d) On the Kingdom of Bahrain National Day, the institute announced an offer to school students, so that for every six students enrolled for the same course, one of them will be free of charge. 252 students registered for 14 different courses. What is the least possible number of students who have been registered for those courses free of charge? [3]
- (e) After the end of all courses, the director of the institute noticed that the institute had achieved the highest possible revenue for the number of enrolled students which totalled 744 students from both levels.
- (e1) How many students are registered in each level? [2]
- (e2) How much revenue did the institute make? [1]
- (f) The director of the institute asked his employees to provide their suggestions with regard to the development of the institute and the introduction of "graphic design" courses; subject to certain conditions including:
- Adhering to the total number of classrooms with the possibility to change the number of current classrooms for any level.
  - Number of classrooms allocated to school, university and graphic design students must each be an even number and greater than 5.
  - The maximum permitted number of students in a graphic design classroom is 14.
  - Up to 5 courses weekly may be offered for graphic design classrooms.
  - Graphic design course fee is BD 8 per student if the number of students enrolled in the course exceeds 10.
- Noora made a suggestion that satisfies all the conditions of the director and generates more revenue than the current system by BD 112 if the maximum number of students in all the institute's classrooms and courses is reached. How many classrooms are allocated to school, university and graphic design students according to Noora's suggestion? [3]

**3 Study the information below and answer the questions that follow. You should show your working.**

Alhedaya Tourism Office arranges daily trips to perform Umrah by plane or by bus.

The office offers booking for flight itineraries through three different airlines. The following table shows departure times from Bahrain International Airport and arrival times at Jeddah International Airport, as well as the timings at Riyadh airport and the prices of tickets for round-trip flights between Bahrain and Jeddah airports:

Airline company	Departure time from Bahrain airport	Arrival time at Riyadh airport	Departure time from Riyadh airport	Arrival time at Jeddah airport	Price (BD)		
					Adult	Child	Infant
First	09:05	10:20	14:20	16:00	113	90	38
Second	11:20	12:30	16:40	18:15	110	95	50
Third	13:30	14:55	18:50	20:30	106	95	37

The office also offers three buses for trips from Manama to Holy Mecca. The table below shows departure times from Manama and arrival times at Holy Mecca. The table only shows the prices of one way trips. A 10% discount is granted for booking in advance the round trips.

Bus number	Departure time from Manama	Arrival time at Holy Mecca	Price (BD)		
			Adult	Child	Infant
1	01:15 am	07:10 pm	27	16	6
2	03:05 am	08:25 pm	25	15	5
3	07:00 am	11:55 pm	30	20	7

- Ages are divided into 3 categories: adults (over 12 years of age), children (2 - 12 years of age) and infants (under 2 years of age).
- Airport procedures takes 20 minutes.
- There are two options to travel from Jeddah International Airport to Holy Mecca and back:
  - Using a taxi that takes a time of 2 hours and 20 minutes to travel from Jeddah airport to Holy Mecca and costs BD 30 for a round trip.
  - Using the local Alsaree' Bus company that takes a time of 3 hours to travel from Jeddah airport to Holy Mecca and costs BD 6 per person for a round trip, excluding infants who are carried free of charge. These buses operate on a specified schedule during the day. The first trip from the airport is at 10:00 am and the last one at 08:30 pm and the buses leave the airport every 30 minutes.
- Buses start their return trip from Holy Mecca to Manama, 6 hours after arrival.
- The trip from Manama to Holy Mecca takes the same time as the return trip from Holy Mecca to Manama by buses.

- (a) How long does the trip take from Manama to Holy Mecca by bus number (2)? [1]
- (b) When will bus number (1) arrive back in Manama if it makes a trip to Holy Mecca on Tuesday? [2]
- (c) Hossam went to Alhedaya office and booked 3 round-trip air tickets to Jeddah Airport for himself, his wife and his son. He paid BD 270. Which airline did Hossam choose? Explain your answer. [2]
- (d) What is the maximum number of outward trips that bus number (3) can make in a week (from Sunday to Saturday), if it starts a trip on Sunday and has to return to Manama each time before it can make the next trip? [1]

- (e) Khalid wants to perform Umrah with his wife, his son Osama (11 years), his daughter Fatima (7 years) and his son Rashid (18 months) during the spring holiday.
- (e1) What is the total cost for Khalid and his family if he decides to travel on a round trip by bus, leaving Manama after 02:00 am and before 05:00 am? [2]
- (e2) What is the least cost for Khalid and his family if he decides to travel by plane to Holy Mecca on a round trip, if he does not want to wait at any airport for more than 4 hours for their connection? [3]
- (f) Sami travelled on a round trip by plane with his family, which consists of at least 1 child and 1 infant, to perform Umrah. He paid a total amount of BD 381 to the Alhedaya office. Specify how many members of each age group make up Sami's family. [2]
- (g) Fahad and Jassim are friends. Fahad wants to travel by plane with his family, whereas Jassim wants to travel by bus with his family. They want to meet in Holy Mecca so that the two families can help one another in performing Umrah and looking after their infants. Fahad met with Jassim and they decided to book trips for which either family will have to wait for the other in Holy Mecca for the shortest possible time.
- How long did the first family to arrive in Holy Mecca have to wait for the other family? [3]

- (h) Bader paid the costs for the trip to perform Umrah by bus to Alhedaya office. However, he later found out from the office that the company for which he works provides offers to its employees to travel via certain airlines that Alhedaya office deals with as shown in the following table:

<b>Airline company</b>	<b>Offer</b>
First	25% discount on all tickets
Second	BD 57 discount on total tickets for purchases of BD 300 or more
Third	There are no offers made by this airline

Bader decided then to travel by plane with his family, which consists of his wife and his son (6 years) to avoid being tired from the road trip and take advantage of his company offers, so he chose an airline which increased the total cost of the round trip to Holy Mecca by BD 150.

Describe **two** possible changes to Bader's plan to travel by plane rather than by bus, stating in each change which airplane company has replaced which bus number, that has led to an increase in the total cost of BD 150. Explain your answer. [4]

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PS12/02E

March 2017

PROBLEM SOLVING

Paper 2 Problem Analysis and Solution

امتحان مارس 2017

حل المشكلات

الورقة 2 تحليل وحل المشكلات

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