



## Instructions

### Preamble

Welcome to this experiment. Thank you for coming. We would be grateful if you would turn off your mobile phone. Please do not talk to the other participants during the experiment.

Please read carefully these Instructions. They are to help you to understand what you will be asked to do in the experiment. You are going to earn money for your participation in the experiment, and you will be paid in cash immediately after the completion of the experiment. All data from the experiment will be stored anonymously.

### Introduction

The participants in this experiment will be randomly divided up into *nine-person groups*. You will never know the identity of the other members of your group. All of you will be presented with a series of *repetitions* of a series of *problems*. Each problem has the same structure. The other members of your group will stay the same throughout all the repetitions of a particular problem. Group members will be randomly changed *between* problems.

### The structure of a problem

As a consequence of the decisions made by you and the other members of your group, you will each receive a payoff on any particular problem. You should imagine that you and the other members of your group are providing nine inputs into some production process; each of you providing part of three of the nine inputs. The output that you jointly produce has value. The value is determined by the decisions of your group's members. The value will be divided equally between the providers of the nine inputs, and then distributed between you and the other members of your group on the basis of the fraction of each input that you each provided.

Each of you has to make an allocation decision. Your allocation decision will determine how much of three of the nine inputs you will provide. The other eight members of your group will be taking similar decisions, each deciding how much to provide of three of the nine inputs. What you decide and what the other members of your group decide will determine the total amounts of the nine inputs you jointly provide. These, in turn, will determine the output and hence your payments. Let us give an example. The payoffs here are expressed in Experimental Currency units (ECU). **10 ECU corresponds to £9.** The example below is a screen shot from the experiment. Note that there is a timer at the top right of the screen; this tells you how much longer the screen will be shown to you. Let us explain. In this example you are Participant 9. You are providing inputs 7, 8 and 9. In this example you provided 6 units of Input 7, 9 units of Input 8 and 21 units of Input 9.

This was repetition 1 out of 7 of problem 1

The next round will start in: 0:07

In this repetition your group produced output valued at 35.7 ECU

Your payment would be 3.5 ECU

	11	12	13	14	15	16	17	18	19	Payoff Input 1	Payoff Input 2	Payoff Input 3	Payoff Input 4	Payoff Input 5	Payoff Input 6	Payoff Input 7	Payoff Input 8	Payoff Input 9	Payoff
Participant 1	11	11	11	-	-	-	-	-	-	1.4	1.1	1.2	-	-	-	-	-	-	3.7
Participant 2	8	7	21	-	-	-	-	-	-	1.0	0.7	2.3	-	-	-	-	-	-	4.0
Participant 3	13	20	4	-	-	-	-	-	-	1.6	2.1	0.4	-	-	-	-	-	-	4.1
Participant 4	-	-	-	4	3	41	-	-	-	-	-	-	0.9	0.3	2.7	-	-	-	3.9
Participant 5	-	-	-	2	31	8	-	-	-	-	-	-	0.5	2.7	0.5	-	-	-	3.7
Participant 6	-	-	-	11	11	11	-	-	-	-	-	-	2.6	1.0	0.7	-	-	-	4.3
Participant 7	-	-	-	-	-	-	5	2	39	-	-	-	-	-	-	1.2	0.2	2.5	3.9
Participant 8	-	-	-	-	-	-	6	33	3	-	-	-	-	-	-	1.4	3.0	0.2	4.6
Participant 9 (You)	-	-	-	-	-	-	6	9	21	-	-	-	-	-	-	1.4	0.8	1.3	3.5
TOTAL	32	38	36	17	45	60	17	44	63	4.0	3.9	3.9	4.0	4.0	3.9	4.0	4.0	4.0	35.7

Your group as a whole provided 32 units of Input 1, 38 units of Input 2, 35 units of Input 3, 17 units of Input 4, 46 units of Input 5, 59 units of Input 6, 17 units of Input 7, 44 units of Input 8, and 63 units of Input 9. These produced output valued at 35.7 ECU. (We shall explain later how this figure is calculated.) Dividing this equally between the nine inputs implies approximately 4.0 ECU ( $=35.7/9$ ) for each input. **Note that figures differ slightly because of rounding.**

For Input 7, as you provided 6 out of the total of 17 units of this input that were provided you get a fraction  $6/17$  of the 4.0 ECU for Input 7; this gives you a payment of 1.4 ECU for Input 7.

For Input 8, as you provided 9 out of the total of 44 units of this input that were provided you get a fraction  $9/44$  of the 4.0 ECU for Input 8; this gives you a payment of 0.8 ECU for Input 8.

For Input 9, as you provided 21 out of the total of 63 units of this input that were provided you get a fraction  $21/63$  of the 3.9 ECU for Input 9; this gives you a payment of 1.3 ECU for Input 9.

So you get a total payment of  $1.4+0.8+1.3=3.5$  ECU.

There are three formulae used here: the first to determine what inputs each of you can provide; the second to determine the value of the output produced by your joint provisions; and the third to determine the payoff to each of you. As the formulae look rather forbidding (see them later in the Instructions), we provide the information on the computer screen.

As to the first, you will see on your screen a figure like that below. This screen is interactive and you can move the cursor to see what combination of the three inputs that you can provide. In the figure at the moment the cursor position implies inputs of 25, 4 and 8. When you have decided on your

chosen provision you should double click. A dialog box will pop up and you can confirm or cancel your decision.

The second formula is to determine the value of the output produced by your joint provisions. Once again the formula is rather forbidding, but you will be able to see the implications on your screen. Examine the figure above, where the value of the output is shown in the bottom right-hand cell of the table. **Note that if the total amount provided of any of the inputs is zero, then the value of output will be zero.**

The third formula is to determine your individual payoffs. As we have stated above, the value of the output will be divided equally between the providers of the nine inputs, and then allocated to you and the other members of your group on the basis of the fraction of each input that you each provided.

#### Deciding and Timing

**When you are happy with the inputs determined by your cursor position, you should double click.** A dialog box will open and you will be able to confirm or cancel your decision. You will see that there is a timer at the top right of the screen. You will not be able to confirm your decision until 10 seconds have elapsed. If you have not confirmed your decision by the time that 60 seconds has elapsed, it will be assumed that you do not want to provide any inputs. In such a case you will receive zero payoff for that repetition. **You should note that if the total provision for *any* input is zero the value of output will be zero.**

#### Number of repetitions and number of problems

There will be 3 problems and 7 repetitions of each. The results screen will be displayed for 45 seconds. **Between problems you will change partners.**

#### Payment

After all 7 repetitions of all 3 of the problems have been completed, the experiment will be over. You will be paid the **payoff on a randomly-selected one of the *final repetitions* of the 3 problems** in the experiment (**converted into pounds at the rate 10 ECU=£9**) plus a show-up fee of £2.50. You will be paid in cash, asked to sign a receipt, and then be free to leave.

Thank you for your participation in this experiment

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## Formulae

*Please note that it is not necessary to understand these formulae: all information will be given on your screen. They are here purely for reference for those who like formulae.*

Let  $x_{ij}$  denote the amount of Input  $i$  that member  $j$  of your group provides. Let  $X_i$  denote the total amount of Input  $i$  that your group provides. Then

$$X_i = \sum_{j=1}^9 x_{ij} \text{ for } i=1..9$$

1. The possibilities open to member  $j$ :

$$\sum_{i=1}^9 x_{ij}^{0.5} = 100^{0.5}$$

2. The implied value of production,  $V$ :

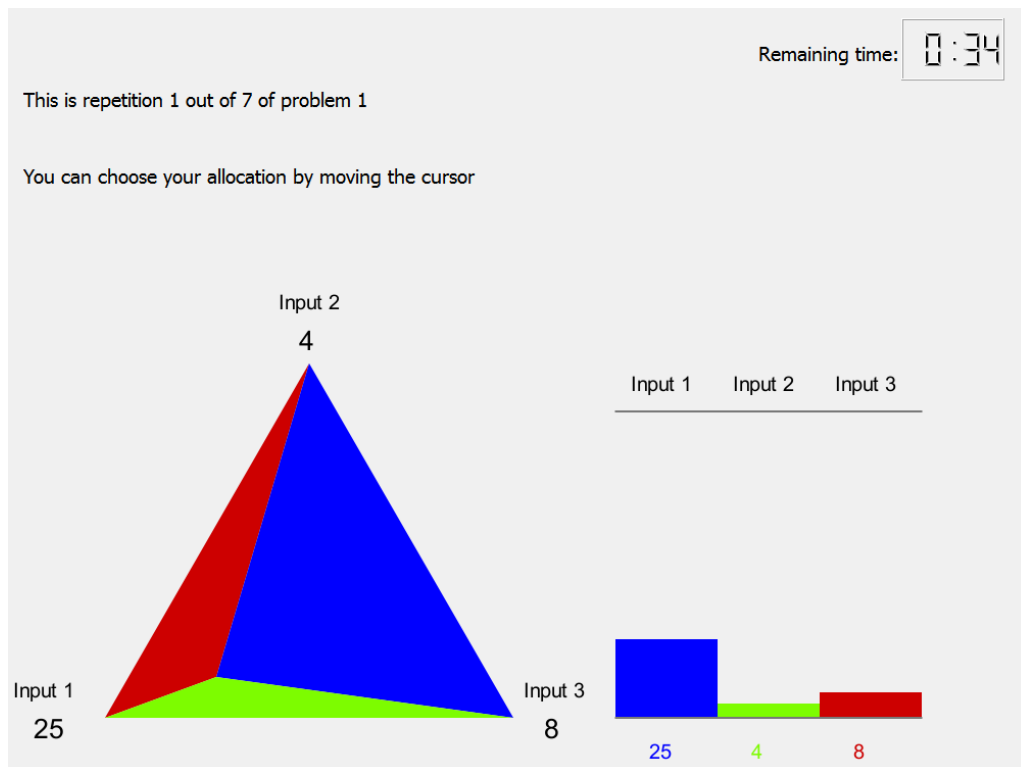
$$\prod_{i=1}^9 X_i^{1/9}$$

**Note that if the total amount provided of any of the inputs is zero, then the value of output will be zero.**

3. The payoff to member  $j$ :

$$\frac{V}{9} \sum_{j=1}^9 \frac{x_{ij}}{X_i}$$

Figure<sup>1</sup>



<sup>1</sup> This assumes you are in a block providing inputs 1, 2 and 3. The input numbers will be changed appropriately for the inputs that you are providing.