Disease Control Problem

Biologists discovered that a number of diseases are activated/controlled by certain genes in our body. For instance, if a disease D is controlled by genes A, B and C, then by targeting **any** of these genes we can block disease D. Targeting genes is of course a costly action (e.g., it takes a lot of research effort to figure out the right ways, and takes time and money to develop the proper medications, etc.)

The following table provides information about seven diseases, their controlling genes, and the cost of targeting those genes.
How can we find a subset of these genes with which we can block all of these diseases and targeting them cost as little as possible?

Disease Control Problem – cont'd

	Genes						
Disease	A	B	C	D	E	F	G
$D1$	X	X			X		
$D2$		X	X		X	X	
$D3$	X		X	X			
$D4$	X					X	X
$D5$		X		X	X		X
$D6$			X		X		X
$D7$				X	X	X	
Cost	5	3	3	8	9	7	2

HW1123

- Assume in the disease control problem that in order to block a disease we may need more than just one gene in the targeted group. Assume that we are given for each disease an integer number indicating the **minimum number** of its controlling genes that has to be targeted to properly control this disease.

HW1123 – cont'd

Disease	*Genes*							
	A	B	C	D	E	F	G	**min-target**
$D1$	X	X			X			**1**
$D2$		X	X		X	X		**2**
$D3$	X		X	X				**2**
$D4$	X					X	X	**1**
$D5$		X		X	X		X	**2**
$D6$			X		X		X	**1**
$D7$				X	X	X		**1**
$Cost$	5	3	3	8	9	7	2	

How to find a cost minimizing target set now?