Blending problem: The steel industry confronts another blending problem when it melts materials in high-temperature furnaces to manufacture new alloys from scrap. Fagersta AB of Fagersta, Sweden, is one of many companies that have used mathematical programming to plan this steel blending. An optimization arises each time a furnace is charged. Scrap in the available inventory is combined with pure additives to produce a blend having the required percentages of various chemical elements. It is critical to make maximum use of scrap because additives are much more expensive. Our fictitious explanatory version of Swedish steelmaking will produce a 1000-kilogram furnace charge. All steel consists primarily of iron. The added table shows the much smaller fractions of carbon, nickel, chromium, and molybdenum in the four available supplies of scrap, on which we can draw, along with the quantities held and their unit cost in Swedish kroner. It also shows the three higher-cost additives that can be used and the acceptable ranges for the resulting blend. For example, the 1000 kilograms of steel produced should contain between 0,65 and 0,75% carbon (i.e. 6,5 and 7,5 kg carbon).

	Composition (%)				Available (kg)	Cost (kr/kg)
	Carbon	Nickel	Chromium	Molybdenum		
1st scrap	0,8	18	12	0	75	16
2nd scrap	0,7	3,2	1,1	0,2	250	10
3rd scrap	0,85	0	0	0	Unlimited	8
4th scrap	0,4	0	0	0	Unlimited	9
Nickel	0	100	0	0	Unlimited	48
Chromium	0	0	100	0	Unlimited	60
Molybdenum	0	0	0	100	Unlimited	53
Minimum blend	0,65	3	1	1,1		
Maximum blend	0,75	3,5	1,2	1,3		

Shift planning & Binary Variables: A computer lab operates 10 hours per day, Monday through Friday. Two five-hour work shifts (9am-2pm and 2pm-7pm) are used for scheduling purposes and two attendants must be present during each shift. The lab currently uses 7 employees. The shifts for which each employee is unavailable are shown in the table below. Each employee must get at least two shifts. Define an MP (Mathematical Programming) Model to find a feasible schedule assignment.

Tanya	Mon & Wed (9-2)
Todd	Tue & Thu (2-7)
Terry	Tue & Thu (9-2)
Tom	Mon (9-2 and 2-7)
Thelma	Mon, Wed, & Fri (2-7)
Theo	Fri (9-2, 2-7)
Theresa	Tue, Thu, & Fri (9-2)