

# IE 303 MODELLING AND METHODS IN OPTIMIZATION

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*Second Computing Project*

*Fall 2021*

**Assignment to be completed individually or in groups of two, due to December 15, 5 pm.**  
**Send your reports to the TAs.**

There is a hospital with a blood donation section with five units next to each other. One day after five women donated blood simultaneously, the secretary forgot to take their record, and managers hired you to do research and hopefully find out each donor's blood type correctly. After your investigation, you observed that each donor has a different shirt color, name, blood type, age, weight, and job. Then you talked with the laboratory workers and they told you they have all the information about the donors but completely mixed up. They also give you a report about what they remember from the instance of donation.

- **Shirt colors:** black, blue, green, purple, red.
- **Names:** Andrea, Brooke, Kathleen, Meghan, Nichole.
- **Blood Types:** A+, AB+, B+, B-, 0-.
- **Ages:** 25, 30, 35, 40, 45 years.
- **Weights:** 120, 130, 140, 150, 160 lbs.
- **Jobs:** Actress, Chef, Engineer, Florist, Policewoman.

Chief security officer also provided a report for you according to what he remembers.

1. The A+ donor is next to the B+ donor.
2. Brooke is at one of the ends.
3. The woman wearing a black shirt is somewhere to the left of the 150 lb woman.
4. The actress is next to the chef.
5. Kathleen is 40 years old.
6. The florist is somewhere to the right of the woman wearing the purple shirt.
7. The oldest donor weights 130 lb.

8. Brooke is next to Nichole.
9. The 35 years old woman is exactly to the left of the 30 years old woman.
10. The 120 lb donor is somewhere between the 0- donor and the 150 lb donor, in that order.
11. Kathleen is at one of the ends.
12. The woman wearing the purple shirt is somewhere to the right of the woman wearing the green shirt.
13. The B+ donor weights 140 lb.
14. The youngest woman is next to the 30 years old woman.
15. The woman considered the universal recipient is exactly to the left of the A+ donor.
16. Meghan is somewhere to the right of the woman wearing the purple shirt.
17. The woman wearing the green shirt is somewhere between the actress and the woman wearing the red shirt, in that order.
18. At one of the ends is the 130 lb woman.
19. The universal donor is 35 years old.
20. The florist is somewhere between the actress and the engineer, in that order.
21. The woman wearing a blue shirt is somewhere to the left of the woman wearing a red shirt.
22. The AB+ donor is next to the youngest woman.

According to all these information, the managers expect you to fill the following table:

	Donor #1	Donor #2	Donor #3	Donor #4	Donor #5
Shirt					
Name					
Blood					
Age					
Weight					
Job					

- a. Formulate the problem of identifying each donor and solve in GAMS or XPress-MP or any other software system of your choice.

**Hint:** Define your decision variables and try to formulate all the clues using linear inequalities. Taking the problem as a variant of assignment problem may be helpful. There may be some implicit constraints you have to carefully find out from the text.

- b. Solve the problem from scratch using some elimination strategy, and show that there is only one optimal solution or feasible point (with respect to your formulation).

**Hint:** You may look for some similar problems like this and learn the solution method.