



CSE260: DIGITAL LOGIC DESIGN

Fall 2024

Assignment 2

Arabika Coffee wants to hire BracU CSE students to design their automated coffee machine. They want their machine to be able to make three of their most popular products: “*Butterscotch Latte*”, “*Cara-Micano*” and “*Americano Espresso*”. The basic ingredients for any of these flavors are Brewed Coffee, full cream milk, sugar, and cocoa powder.

Input (4 variables)

$C = 1$ indicates the presence of Brewed coffee.

$M = 0$ indicates the absence of full-cream milk.

$S = 1$ indicates the presence of sugar.

$P = 0$ indicates the absence of Cocoa Powder.

Output (3 variables)

$B = 1$ indicates *Butterscotch Latte* is ready.

$C = 0$ indicates *Cara-Micano* isn't ready.

$A = 1$ indicates *Americano Espresso* is ready.

Arabika Coffee authorities have asked to consider the following points (conditions) when designing the system:

1. Without Brewed coffee it is **impossible** to make **any type of product**.
2. Brewed coffee and milk are essential for making *Butterscotch Latte*. Sugar is an optional (may or may not be there) ingredient. Cocoa powder isn't needed to make this.
3. Brewed coffee and sugar are essential for making *Cara-Micano*. Full-cream milk is not traditionally part of *Cara-Micano*. Cocoa powder is used as a garnish.
4. *Americano Espresso* is just brewed coffee. Sugar is an optional (may or may not be there) ingredient. Cocoa powder and milk are not needed to make *Americano Espresso*.

- a) Using the above description, prepare a truth table for the automated coffee machine.
- b) Using the 4-variable Karnaugh-Map method, derive SOP expressions for all of the three mentioned above.

[Ungraded Task]

The recent Mpox outbreak in certain regions has prompted public health officials in Bangladesh to seek a system that can help monitor and manage individuals arriving from high-risk areas. They have requested the CSE department of BRAC University to develop a system capable of assessing the health status of incoming individuals and ensuring appropriate measures are taken to reduce potential spread within the community. Health officials have approved the following specifications for the system:

Input (4 variables)

F = 0 indicates the person DOES NOT have FEVER.

H = 1 indicates the person HAS HEADACHE.

M = 0 indicates the person DOES NOT have MUSCLE ACHES.

S = 1 indicates the person HAS SWOLLEN LYMPH NODES.

Output (3 variables)

I = 1 indicates the person should isolate at home following guidance from the health care provider (well-ventilated room if possible).

T = 1 indicates the person is at RISK and needs to contact a healthcare provider for advice.

G = 1 indicates the person is out of risk.

The Health officials have asked to consider the following points (conditions) when designing the system:

1. A person who has FEVER and HEADACHE and any one of the other two symptoms (MUSCLE ACHES or SWOLLEN LYMPH NODES) should be ISOLATED.

2. A person who has TWO OR MORE symptoms out of the four should be sent for ADVICE.
3. A person who does not fall in any of the above criteria is out of risk.

PLEASE NOTE THAT THIS POINTS ARE GIVEN IN ORDER OF PRIORITY. So, 1 HAS THE HIGHEST PRIORITY AND 3 HAS THE LOWEST.

- a) Using the above description, prepare a truth table for the system.
- b) Using the 4-variable Karnaugh-Map method, derive SOP expressions for all of the three outputs.
- c) Using the equations found in part (b), draw the circuits.