

## **Project proposal ideas**

### **Sotiria (CEE 202) – Venn Diagram, Tree Diagram**

- 1) Construction companies A and B bid for projects. Let events with the same notation be defined as:

Event A: company A wins the bid

Event B: company B wins the bid

Draw a Venn diagram for the following cases:

- a) it is possible for companies A and B both to win the bid.
- b) other companies also submit bids but if one of the companies A or B wins the other one cannot win the bid. How are events A and B called in this case?
- c) there are no other companies bidding, only A and B. Only one can win the bid.

- 2) Use Venn diagrams to verify DeMorgan's rules

- 3) The direction of the prevailing wind at a particular building site is between East ( $\Theta=90^\circ$ ) and due North ( $\Theta=0^\circ$ ). The wind speed (ws) can be any value between 0 and 300 km/hr

- a) Sketch the sample space for wind speed and direction
- b) Denote events

$$E1 : ws > 35 \text{ km /hr}$$

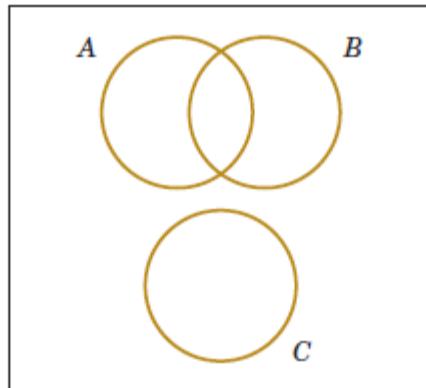
$$E2 : 15 \text{ km/hr} < ws \leq 45 \text{ km/hr}$$

$$E3: (\Theta \leq 90^\circ)$$

Identify events E1, E2, E3, E1' (complement for E1) within the sample space of part a

- c) Draw new sketches and identify the following
  - a. E1 intersection E2
  - b. E1 union E2
  - c. E1 intersection E2 intersection E3

**2-20.** Three events are shown on the Venn diagram in the following figure:



Reproduce the figure and shade the region that corresponds to each of the following events.

4.  (e)  $(A \cap B)' \cup C$

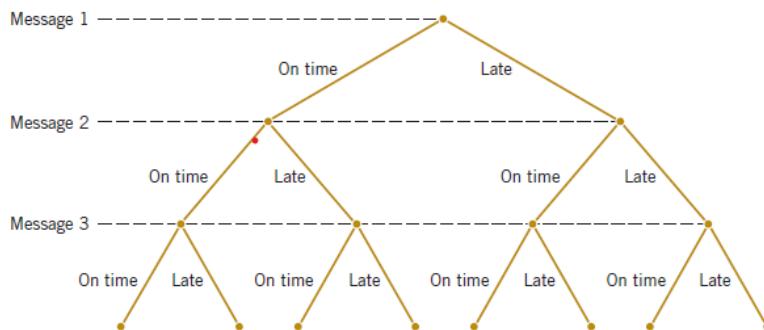
5.

### Example 2-3

**Example 2-3** **Message Delays** Each message in a digital communication system is classified as to whether it is received within the time specified by the system design. If three messages are classified, use a tree diagram to represent the sample space of possible outcomes.

Each message can be received either on time or late. The possible results for three messages can be displayed by eight branches in the tree diagram shown in Fig. 2-5.

**Practical Interpretation:** A tree diagram can effectively represent a sample space. Even if a tree becomes too large to construct, it can still conceptually clarify the sample space.



**FIGURE 2-5** Tree diagram for three messages.

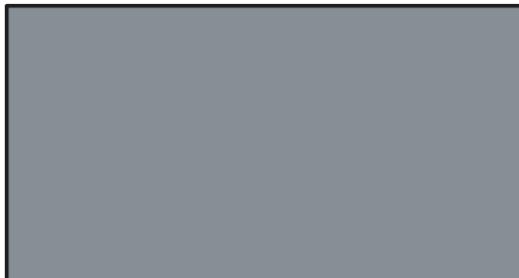
## Fraida – Image annotation

1.

Upload

Student uploads image.

2. Student annotates to show these elements, e.g.:



destination MAC

frame type

Instructor defines, for each annotation that will be added -

1. the shape - rectangle, line, point
2. the color
3. whether it is resizable
4. the label that goes along with it

3. looks something like..

```
> Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits)
  ▾ Ethernet II, Src: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
    Address: Broadcast (ff:ff:ff:ff:ff:ff) Locally administered address (this is NOT the ...
    ....1.... Group address (multicast/broadcast)
      ....1.... destination MAC
    Address: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85) Locally administered address (this is NOT the ...
    ....1.... .... = LG bit: Locally administered address (this is NOT the ...
    ....0.... .... = IG bit: Individual address (unicast)
    Type: ARP (0x0806)
  ▾ Address Resolution (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Operation request (1)
    Sender MAC address: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85)
    Sender IP address: 10.0.0.100
    Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
    Target IP address: 10.0.0.101
```

4. instructor gets: image, bounding boxes, ideally the snippet of image that is selected.

The goal is to auto-grade this type of question, at least for certain scenarios. Doing OCR is a stretch goal, but as a minimum deliverable, the element should provide some kind of API to allow auto-graders to easily extract the bounding boxes (e.g., as an image of just the box content) that can then be processed by software that an instructor might write themselves later.

See examples below for some other use cases (not all of which are realistically auto-gradable).

```
> Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits)
✓ Ethernet II, Src: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  Destination: Broadcast (ff:ff:ff:ff:ff:ff)
    Address: Broadcast (ff:ff:ff:ff:ff:ff) (ffff:ffff:ffff:ffff:ffff:ffff)
      ....1..... .... = LG bit: Locally administered address (this is NOT the ...
      ....1..... .... = IG bit: Group address (multicast/broadcast)
  Source: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85)
    Address: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85)
      ....1..... .... = LG bit: Locally administered address (this is NOT the ...
      ....0..... .... = IG bit: Individual address (unicast)
  Type: ARP (0x0806) (0x0806)
✓ Address Resolution Protocol (request)
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: request (1)
  Sender MAC address: 02:77:c4:3c:6c:85 (02:77:c4:3c:6c:85)
  Sender IP address: 10.0.0.100
  Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
  Target IP address: 10.0.0.101 (10.0.0.101)
```

```
router-1:~$ ip route show dev eth1
10.10.0.0/16 via 10.10.100.3
10.10.1.0/24 via 10.10.100.2 applied
10.10.100.0/24 proto kernel scope link src 10.10.100.1
```

```
@router-a:~$ ip route show dev eth1
10.1.10.0/24 proto kernel scope link src 10.1.10.1
10.1.234.64/26 via 10.1.10.3    from romeo to othello
10.1.234.128/25 via 10.1.10.2   from romeo to hamlet
@router-a:~$ ip route show dev eth2
10.1.234.0/27 proto kernel scope link src 10.1.234.1   from hamlet to romeo
```

```
.....!.'.....#.!'.....!.".....'.....38400,38400....'.....xterm-256color.....Ubuntu 20.04 LTS
server: [REDACTED]-205862.nyu-ece6353-pg0.utah.cloudlab.us login: sshhaakkeessppeeaaallee
: Password: [REDACTED]                                     password
:                                                               username
Welcome to Ubuntu 20.04 LTS (GNU/Linux 5.4.0-164-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

* Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
just raised the bar for easy, resilient and secure K8s cluster deployment.

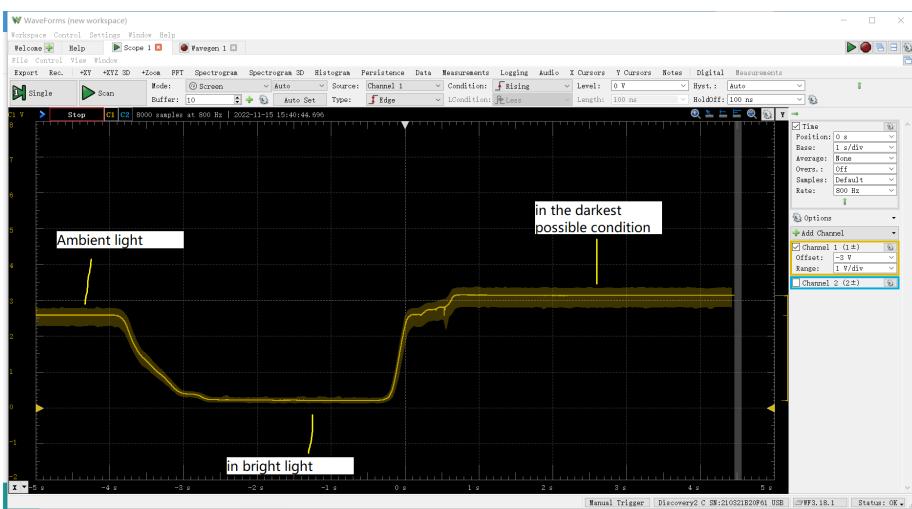
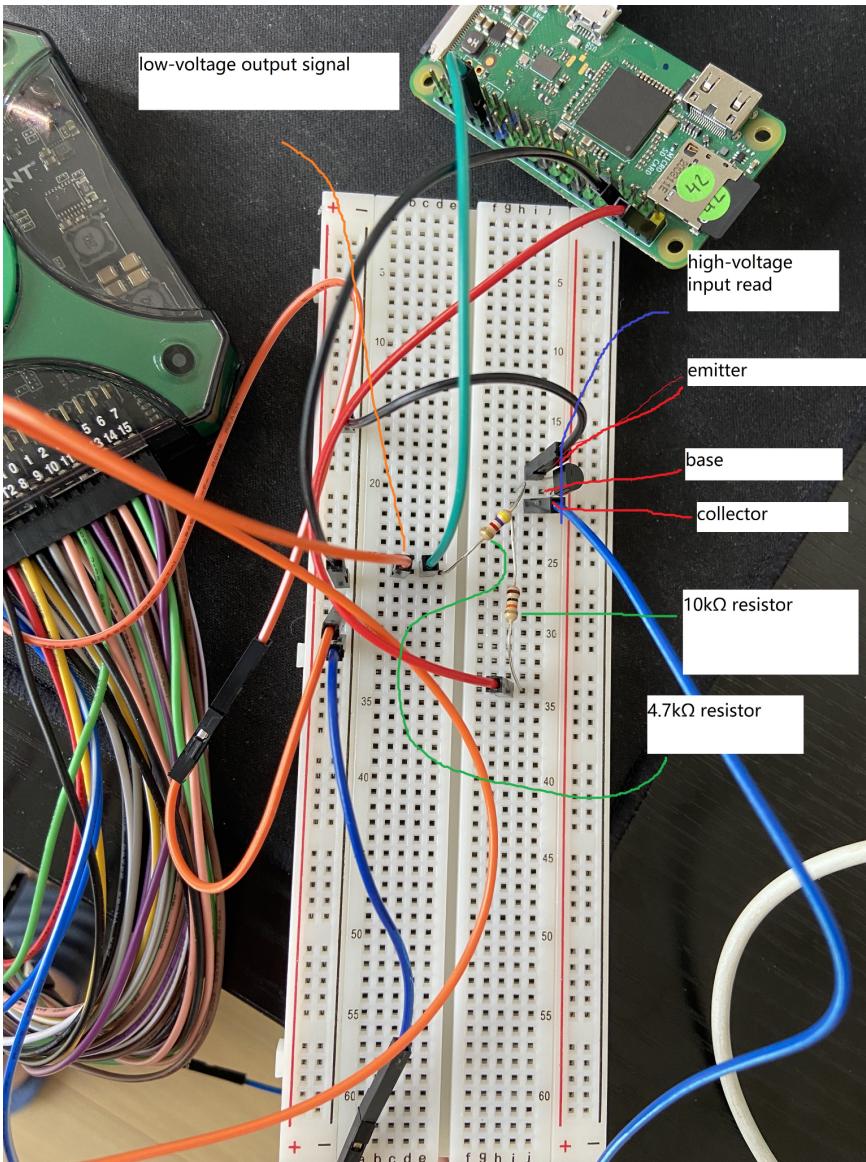
https://ubuntu.com/engage/secure-kubernetes-at-the-edge
New release '22.04.3 LTS' available.
Run 'do-release-upgrade' to upgrade to it.
```

The programs included with the Ubuntu system are free software; the exact distribution terms for each program are described in the individual files in /usr/share/doc/\*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable law.

```
$ ddaattee  
. .  
Sat 04 May 2024 11:57:05 AM MDT  
$ hhoossttaa.. .nnaamme  
$ .  
server. [REDACTED] -205862.nyu-ece6353-pg0.utah.cloudlab.us  
$ eexxiitt
```

session data



## Brian (ECE) – Circuit topology drawing,

### Example 2.4.6 Draw the schematic for a rear windshield defroster

**Background:** Window defrosters melt frost from the rear car window via resistive heating. The thin horizontal lines in Figure 2.44 are identical resistive heating elements, which are wires with significant resistance so that they provide heat when current flows through them. The thick vertical lines are bus bars (large conductors) with relatively negligible resistance.

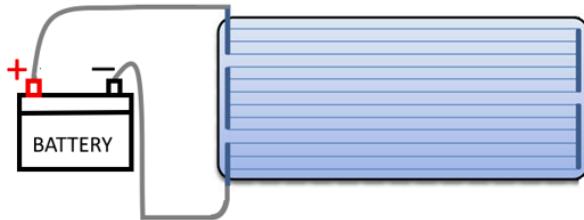


Figure 2.44 Wiring diagram of a rear window defroster Image courtesy of The PipeKnife Company/Clear View II [www.frostfighter.com](http://www.frostfighter.com)<sup>10</sup>

#### Problem:

- Draw the circuit schematic for this system. Make electrical series and parallel relationships between components as visually obvious as possible.
- The heating elements can be trimmed shorter to match the length of the windshield. Explain why shorter defroster wires produce more heat than standard length wires. Hint:  $R = \rho l/A$ .

#### Solution:

- Each bus bar (shown thick) is one node. The defroster has groups of three elements (wires, shown thin) in parallel for each horizontal run, and four such runs. Figure 2.45 shows a circuit schematic that preserves mechanical information and another with clearer electrical relationships. Elements running parallel *mechanically* may/may not be connected in parallel *electrically* – the connections on the schematic are the key to being in series or in parallel.

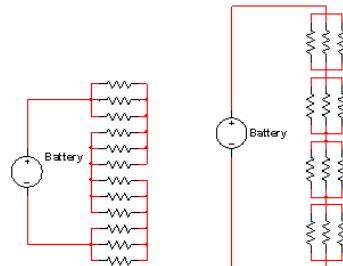
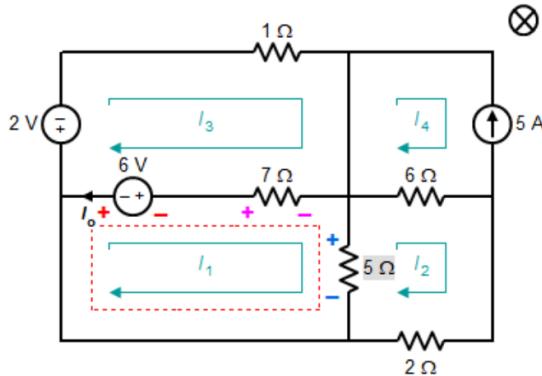
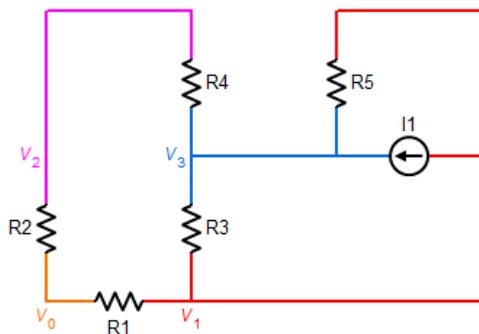
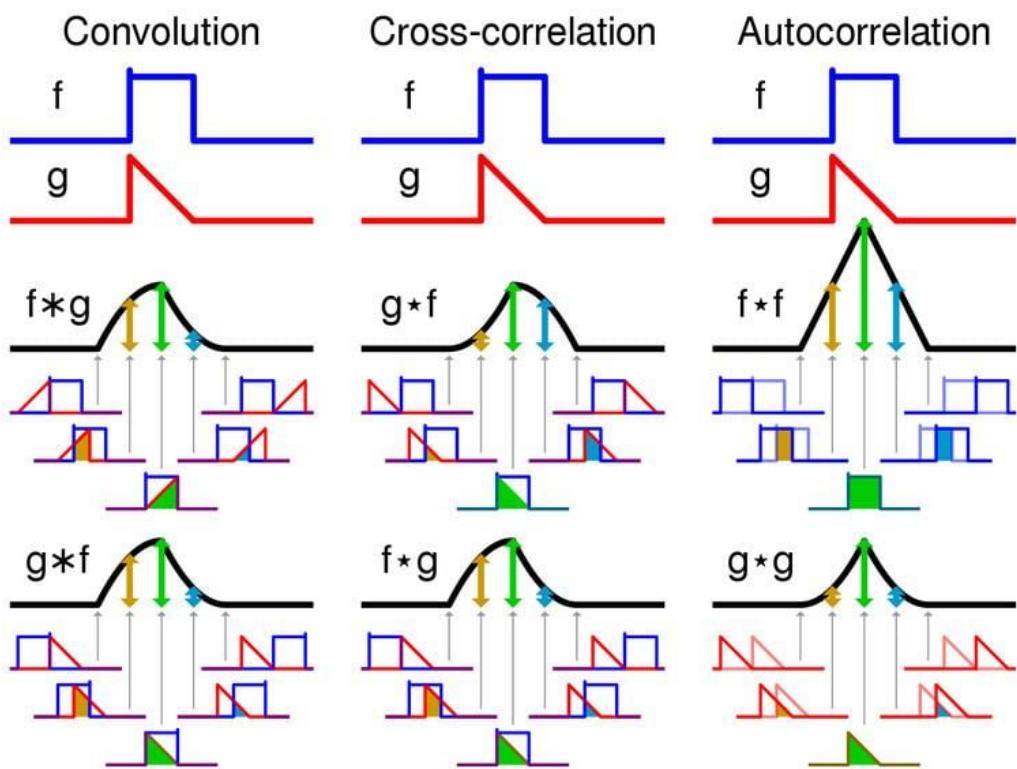
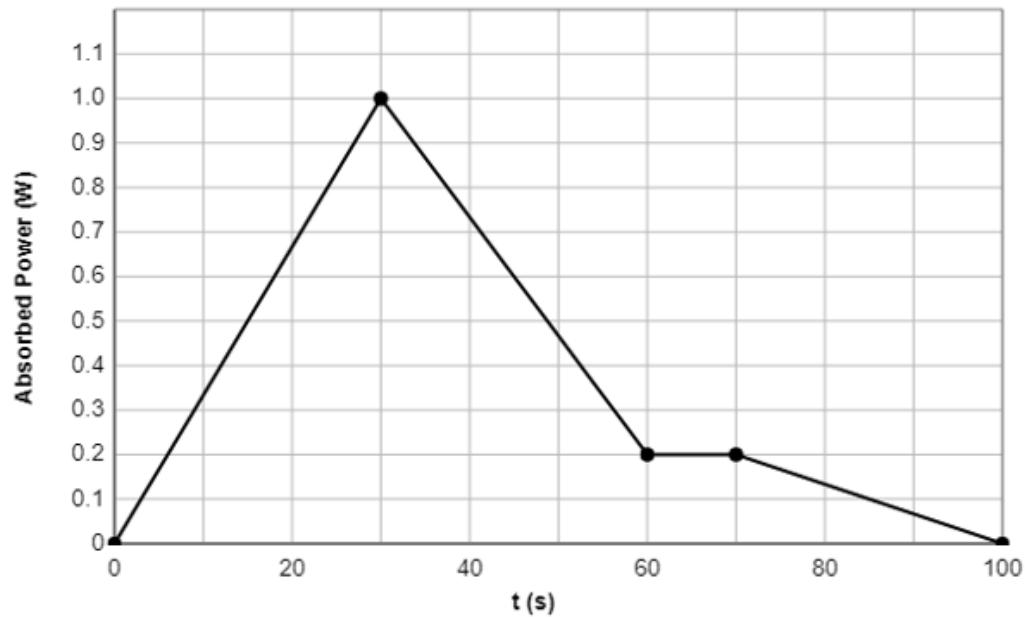


Figure 2.45 Schematics for the rear window defroster

- Shorter elements have lower resistance. Batteries are voltage sources. The power (heat) produced is  $V^2/R$ . Because resistance is in the denominator, lower  $R$  yields greater power.



## Drawing mathematical functions



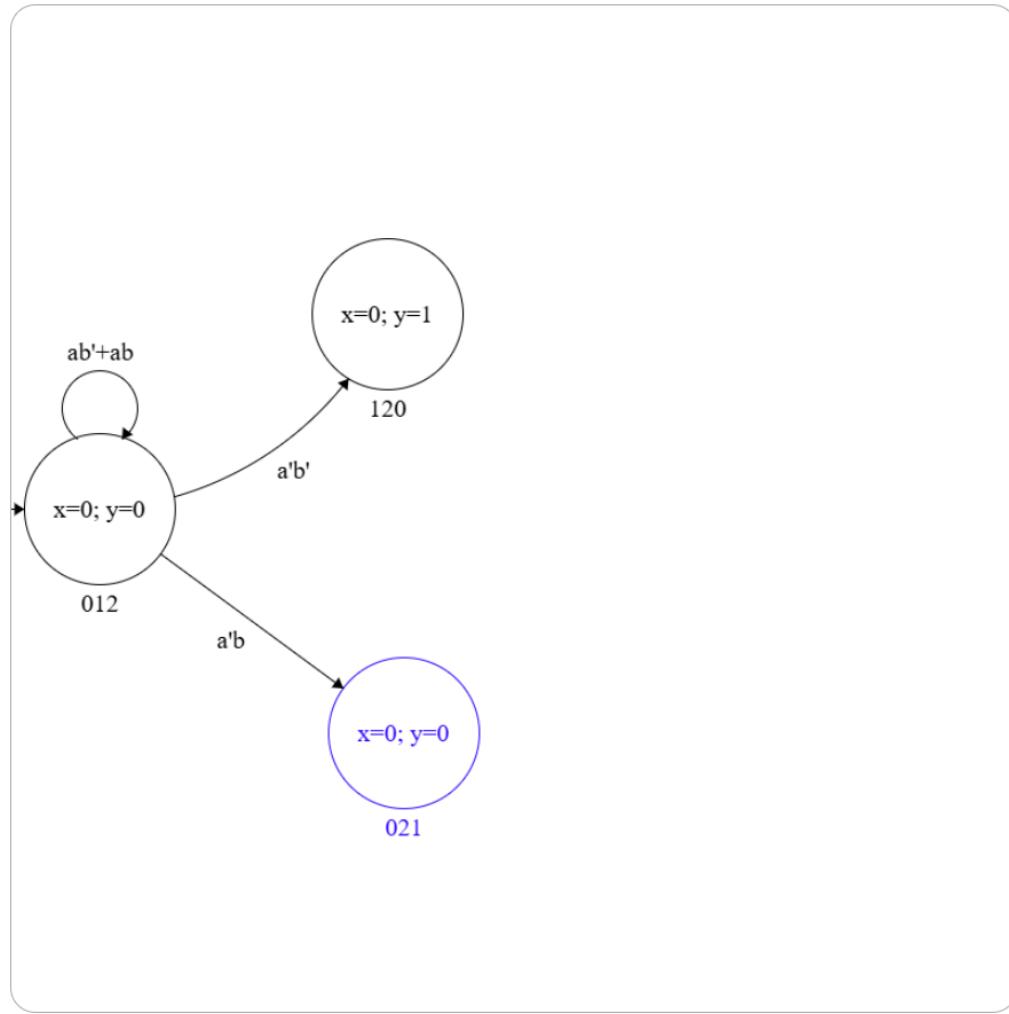
## Geoffrey (CS/ECE) –finite state machine element update

### Finite State Machine (Least Recently Used)

Design a finite state machine that determines the least recently used number in a set. For this FSM, the set of numbers is (0, 1, or 2). For example, for the sequence 0, 1, 0, 2, 0, 2, where the left-most number is the first number to appear in the sequence, the least recently used number would be 1 because 0 and 2 were both used more recently than 1.

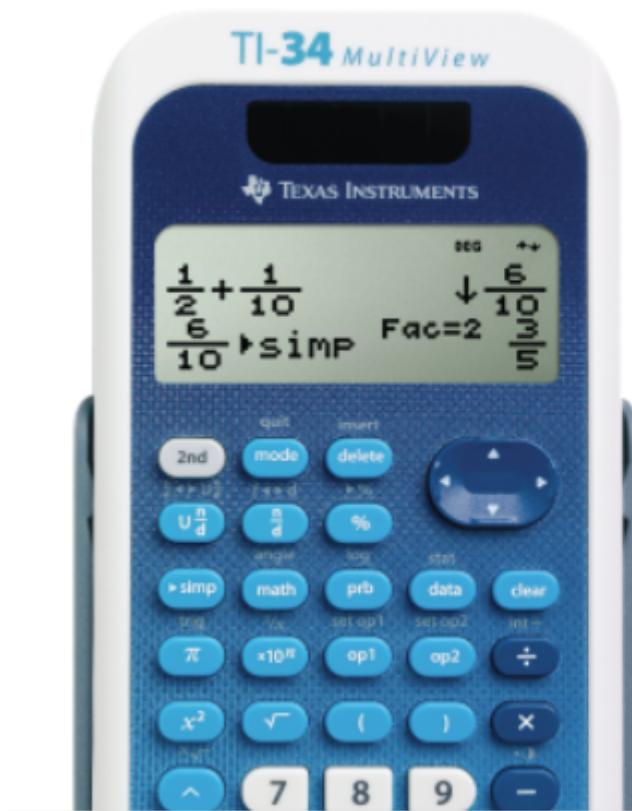
Your FSM receives a 2-bit unsigned binary number ( $ab$ ) that encodes the values 0, 1, or 2. Each cycle your FSM must output the 2-bit unsigned binary number ( $xy$ ) that indicates which number was least recently used. Your start state should use the assumption that the numbers 0, 1, 2 were previously seen in that order, making 0 the least recently used number.

If an illegal number that is not part of the set is received as an input, return to the same state.



## **Single Cell Jupyter lite**

## Scientific Calculator



## Key features

- » Four-line display
- » One- and two-variable statistics
- » MathPrint™ feature
- » Advanced fraction capabilities
- » Step-by-step fraction simplification
- » Edit, cut and paste entries
- » Solar and battery powered

**Ideal for** middle school math, pre-algebra, algebra I and II, general science and geometry.

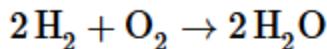
### Exam acceptance

The TI-34 MultiView™ scientific calculator is approved for use on SAT®, ACT®, and AP® exams.

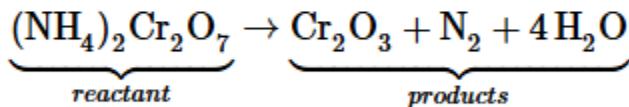
## Chemical notation rich text editor

H<sub>2</sub>O vs H<sub>2</sub>O

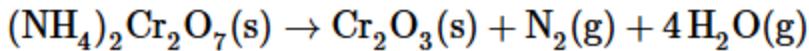
**Chemical equations.** For example, hydrogen gas (H<sub>2</sub>) can react



licate the starting materials, or reactants, which by convention are written on the left. An arrow points from the reactant to the products, which are written on the right.



ation 3.1.1 indicates that ammonium dichromate (the reactant) decomposes to form chromium(III) oxide, nitrogen gas, and four molecules of water. This reaction is more informative when written as follows:



...   ...   ...   ...   ...   ...   ...   ...   ...