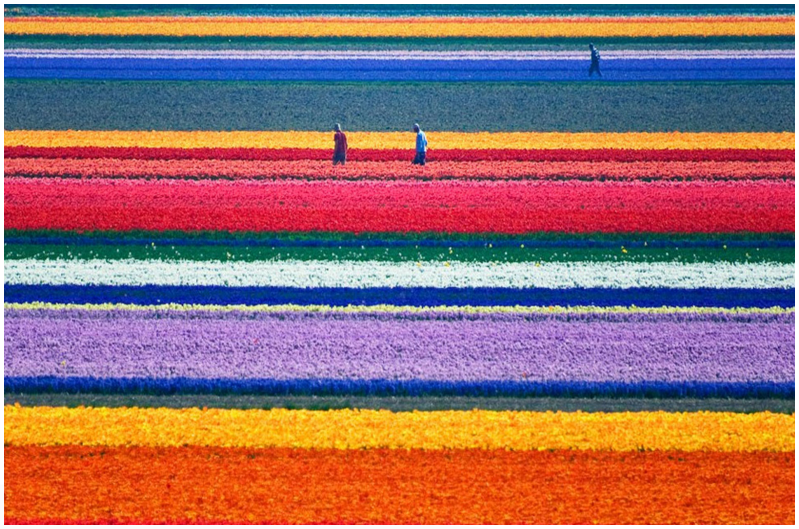
Final:
Tulip Germination

Tulip Fields in the Netherlands



Tulips in Netherlands

- Came to Netherlands in mid-16th century and quickly become a symbol of the region.
- Tulips bloom between mid-March to the end of May and attract tourists from all over the world.
- 9 million bulbs produced annually.
- Account for 25% of agricultural exports.

Growing Tulips

- Best to plant tulips in the Fall.
- Require a “chilling time” to bloom.
- Need to be planted in well-drained and airy soil (flooding can be devastating to tulips).
- Once they start to grow, require lots of sunlight.

Climate Change in the Netherlands

1. Observed temperature rise is about twice global average.
2. Precipitation may increase by as much as 5%.
3. Higher risk of flooding
4. Increases in sea levels affect negative elevation areas.

Tulip Germination Experiment

- Goal: Understand the effect of chilling time on germination of tulip bulbs.
- Data:
  - 210 bulbs from 12 different "populations" collected from the fields between the years 2005-2009.
  - Each population randomly split into 7 groups (30 in each group) and assigned to one of 7 different chilling times (0, 2, 4, …, 12 weeks).
  - Response was if bulb germinated (sprouted).

Tulip Experiment Summary Statistics

	Pr(Germination|Pop,Chill)						
	Chilling Time						
Population	0	2	4	6	8	10	12
1	0.40	0.97	0.83	0.87	0.87	0.97	0.90
2	0.13	0.53	0.73	0.73	0.83	0.90	0.83
3	0.00	0.53	0.80	0.83	0.97	0.90	0.87
4	0.00	0.17	0.53	0.60	0.73	0.90	0.73
5	0.33	0.87	0.67	0.73	0.70	0.57	0.50
6	0.00	0.03	0.07	0.40	0.43	0.80	0.67
7	0.00	0.00	0.10	0.33	0.47	0.83	0.67
8	0.00	0.03	0.27	0.33	0.33	0.30	0.30
9	0.00	0.00	0.00	0.00	0.07	0.60	0.60
10	0.00	0.17	0.10	0.53	0.87	0.87	0.83
11	0.00	0.00	0.20	0.23	0.67	0.83	0.47
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tulip Experiment Research Questions

- Is the affect of chilling time the same across all populations? Which populations are same/ different?
- Is there an "ideal" chilling time? Does this ideal chilling time vary by population?
- What effect will a decrease from 10 to 8 weeks of winter/chilling time have for tulips?

Rules for the Final

- Reports must be done on your own – please minimize talk between each other.
- Final reports are oral whenever you're done (but must be completed by April 23).
- I'm available to answer coding and "how" questions but not "what" questions.

Expectations for the Final

- Answer the research questions explicitly!
- Follow the rubic!
  - Give “birds eye view” of techniques you use.
  - Clearly state and justify your assumptions and whatever model you use.
  - I want to see uncertainties (particularly for the “ideal” chilling time)!