Kruskal’s Count Card Trick Lesson Plan

Amount of time Demo takes: 3-5 mins.
Try this at home!

Materials
- A deck of cards
- A Mind Trekkers button/bracelet

Set-up Instructions
1. Lay out the cards face up, in rows of whatever number. In your head, starting with the first card, you will trace a “walk” to the trap card:
   a. “Start at the first card and whatever number is on it "walk" this many cards to the right, treating ace as a 1 and face cards as 5 (all other cards are their face value). Repeat the "walk" from the new card, continuing until you near the end” (UML Website and included diagram).
   b. Place the button/bracelet on one of the last cards you can land on.
2. “Bet” the students that, when they pick one of the first ten cards as their starting point, they will also land on your ‘trap’ card. Feel free to give away the buttons/bracelets if you have indeed chosen the trap card incorrectly (you’ll lose about 20% of the time).

Lesson’s Big Idea
- When they follow the “path” (see below) through the cards, there is an ~80% percent chance that they will land on your trap card. This is because as you lay the cards, you trace out a path of your own leading to the card. At some point, it’s likely that the student’s path will cross yours -- once in your track, they’ll be forced to land on the same card as you.
  o This trick works 95% of the time with two decks of cards; the probability of landing within your path is much higher.

Background Information
- “Walk”-Path from point A to point B. In this case, the lengths of the walks are determined by the values of the cards.
- From any given card, there are at most 10 cards within its’ reach (aces can reach one card, twos can reach two, and so on. Face cards can reach five
cards). At least one of those ten cards appeared in your walk when you began with the first card. There is a 1/13 chance that the card the student chooses to begin from is one that’s on your walk -- and once your paths overlap, they’ll end up in the same place you did!

**Instructional Procedure**

1. Shuffle the deck and lay out all of the cards face-up in several rows. Count the walks in your mind and mark the “trap” card.
2. Invite students to choose one of the first ten cards, betting them that they will land on the “trap.”
3. Beginning at the card they chose, move along the rows counting as follows:
   a. From an ace, walk one card to the right.
   b. From a two to ten, walk card value to the right.
   c. From a face card, walk five cards to the right.
4. See where they land -- about 80% of the time, they will find themselves on the trap! If it fails, don’t fret. Just shuffle it up and deal again.
5. If you or the students are confused, try this:
   a. After the trick is over, start the count from the first card (to show how you picked a trap). Turn this first card sideways, then walk that number of cards. Turn that card sideways -- repeat. This visually illustrates your path.
   b. Then, begin at the card they chose and begin walking. It will be obvious when they land in your path, since they’ll suddenly be on a sideways card.
6. This trick is about 95% accurate with two decks of cards.
7. Shuffle the deck and deal again for the next group.

**Assessment/sample questions you can ask**

1. How did I know which card was the “trap?”
2. Does this work each and every time?

**Clean Up**

- Put away the cards, making sure that all 52 are accounted for.

**References**

- [http://faculty.uml.edu/rmontenegro/research/kruskal_count/index.html](http://faculty.uml.edu/rmontenegro/research/kruskal_count/index.html)
• Play the game yourself to get used to it:
  http://faculty.uml.edu/rmontenegro/research/kruskal_count/kruskal.html

**Next Generation Science Standards**

• Pattern based