Mahjong and mathematics

Chi-Kwong Li

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Objectives of the presentation/expected learning outcomes

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• Describe some background about the mahjong game.

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- Study some of its mathematical aspects. Learn the connection between mathematics and other activities.
- Describe some related research opportunities. See how some research problems arise.

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- It is usually played by 4 persons (with 3-person or 2-person variation).
- Mahjong is a game of skill, strategy and calculation and involves a certain degree of chance.
- In Asia, mahjong is also popularly played as a gambling game though it may just as easily be played recreationally.

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Others believe that two brothers from Ningpo - created mahjong around 1850, from the earlier game of Ma Diao.

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- The prohibition was revoked in 1985.
- Today, it is a favorite pastime in China and other Chinese-speaking communities.

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- A total of 12,000 mahjong sets were sold quickly.

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- By the 1930s, many revisions of the rules developed that were substantially different from Babcock's classical version.

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- Recently, a second organization has formed, the American Mah Jongg Association. The AMJA currently hosts tournaments all across North America.

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- Mahjong culture is still deeply ingrained in the Chinese community. People have used mahjong as the themes of pop music and movies in Hong Kong. http://mahjongmovies.net/wordpress/

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- Studies by doctors have also shown in Hong Kong that the game is beneficial for individuals suffering from dementia or cognitive memory difficulties, leading to the development of mahjong therapy.

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The game set

The game is played with a set of $136\ {\rm tiles:}$



Circles or Dots numbered 1 to 9.



Characters numbered 1 to 9.



Bamboos numbered 1 to 9.



The East, South, West and North



The Red, Green and White Dragons

Each has 4 copies summing up to 34 * 4 = 136 pieces.

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• Examples of winning hands.



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- Each player will pick 13 tiles initially.
- Each player takes a turn picking up a tile from the wall and then discarding a tile by throwing it into the centre of the table.
- Play continues this way until one player has a winning hand by picking up the winning piece from the wall, or seeing someone discard a piece that he/she can use to form the winning hand.

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• A special hand with 9 possible winning possibilities.



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• A non-trivial example:



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• How about a hand with m winning possibilities for $m \in \{1, \ldots, 9\}$?

- Construct a hand of "characters" different from the example in class that can win with 7 possible pieces.
- Show that you can or you cannot construct a hand of "characters" that can win with 8 possible pieces. Explain your answer.

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- Construct a hand of "characters" different from the example in class that can win with 7 possible pieces.
- Show that you can or you cannot construct a hand of "characters" that can win with 8 possible pieces. Explain your answer.
- Extra credits/open problem: Construct a hand of "characters" that can win with m possible pieces with m ∈ {1,...,9}.
 Generate all character hands with m winning pieces for some/all m.
 Write a computer program to recognize all winning patterns.

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