### MA111: Contemporary mathematics

Jack Schmidt

University of Kentucky

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Schedule:

- HW 11A due Monday Nov 7, 2011.
- Prelim project due Wednesday Nov 9, 2011.
- HW 11B due Monday Nov 14, 2011.
- Chapter 11 Exam Monday Nov 14, 2011.

Today we are going over the seven Frieze groups and border patterns.

### The least of them: Hop symmetry

- Hop symmetry is generated by a single translation
- Hop symmetry is determined by a distance D
  It contains all left or right translations by integer multiple of D







• No reflections, no rotations, no glide reflections

# A single reflection: Jump symmetry



 Jump symmetry also contains glide reflections, but it contains both the "glide" and the "reflection" separately so the homework and book sometimes claim it has none

# A glide reflection: Walk symmetry

• Walk is generated by Hop and a glide reflection



• No rotations, no horizontal reflection, no vertical reflections

## Two vertical reflections per: Sidle symmetry

• Sidle is generated by Hop and a reflection over a vertical line



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- Sneaky sidle has **two** vertical reflections per pattern Can you find the "other" one?
- No rotations, no glide reflections, no horizontal reflection

## Two half-turn rotations per: SpinHop symmetry

• SpinHop is generated by Hop and a half-turn rotation





- Sneaky SpinHop has **two** half-turn rotations per pattern Can you find the "other" one?
- No reflections, no glide reflections

# My favorite: SpinSidle symmetry

• SpinSidle is generated by SpinHop and Sidle



- Sneaky SpinHop has two of each half-turns and vertical reflections
- Has a "primitive" glide reflection (so no horizontal reflection)

# Everything: SpinJump symmetry

• SpinJump is generated by SpinHop and Jump



• SpinJump has everything!