# $\sqrt{CCML}$ Video Contest – Meet 3 2017-2018

## Guidelines

- Students from each half of your team (freshman/sophomore or junior/senior) from your school may submit up to two videos on the given problem. Each video submitted must be produced by different students, but must all be from the appropriate grade band. If your school decides to submit two f/s videos, there should be different students in each video.

- Each video should be no more than SIX minutes in length. Note that this does not mean that you have to fill the entire six minutes.

- The problems are to be solved and the videos produced by student groups. The bulk of the work should be done by students. A parent or teacher holding a camera is fine, but solving a problem for the students is not.

- Videos must be produced by a group of at least two students, and at most five students. Each participating student's contribution should be made evident either from an appearance in the video or a credit at the beginning or end of the video. Indicate names of all students involved (maximum of 5) in credits or introductions at the beginning or end of the video.

- The top f/s video and j/s video from your school with earn points for your overall team score according to the attached rubric.

- Creative solutions and presentations are encouraged, but correct math is paramount. Please make the focus of your video the mathematics. If you have a creative context, great, but it should not be the focus of your video. Soundtracks should not distract or interfere with the explanation of the solution.

## Submission

- Coaches should ensure that no more than two videos per grade band are submitted.

- Coaches should upload videos to Google drive and share access with Michael Caines (macaines@cps.edu). Please use the following naming conventions for the videos: **school_level_teamnumber_contestnumber_year**. For example, a submission for CCML 3 for an f/s team from Kelly in the 2015−2016 school year should be named as follows, **kelly_fs_team1_contest3_1516**. A submission from a j/s team from Lakeview should be named **lakeview_js_team1_contest3_1516**

- **All submissions must be shared by 5pm on Monday, January 22, 2018.**

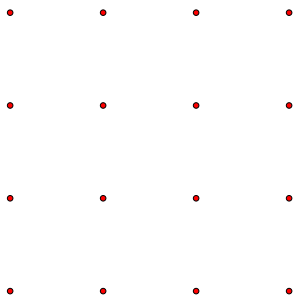
Please direct any questions about the contest to Michael Caines (macaines@cps.edu). Coaches who are interested in helping judge the submissions should email Michael Caines by the submission deadline.

**Problems:**

- **Freshman/Sophomore Problem:**

(a) Consider the set of prime positive integers that are less than 100. Determine the sum of the (arithmetic) mean and the median of this set.

(b) Determine the arithmetic mean of the slopes of all nonvertical lines that contain two or more lattice points on the rectangular grid at right.



(c) If three lattice points on the grid at right are selected at random, what is the probability that they are vertices of an obtuse triangle?

- **Junior/Senior Problem:**

**Note: this problem is based upon the topic of Markov chains, which not part of the usual CCML topic list. This topic was selected because it matches the ICTM orals topic. You may need to do additional research before doing these problems.**

(a) A simple model for summer weather states that each day is rainy, cloudy, or sunny. If a particular day is sunny, there is a 60% chance the next day will be sunny, a 30% chance it will be cloudy, and a 10% chance it will be rainy. If a day is cloudy, there is a 30% chance the next day will be sunny, a 40% chance the next day will be rainy, and a 30% chance the next day will be cloudy. Rainy days are followed by sunny days 50% of the time, by cloudy days 30% of the time, and by rainy days 20% of the time.

Suppose that for Monday, the weather report gives an 80% chance of sun, a 15% chance of clouds, and only a 5% chance of rain. Find the probability of each type of weather on Friday.

(b) A population of 100 things is initially equally distributed among five states: A, B, C, D, and E. Transitions between states occur at regular intervals according to the following probabilities: A to B: 0.5, A to C: 0.5, B to B: 0.5, B to C: 0.5, C to B: 0.2, C to C: 0.8, D to E: 1, E to D: 0.1, E to E: 0.9.

What is the expected distribution of the things as time increases without bound? (In other words, find the equilibrium distribution or show why one does not exist.)

(c) You have an unfair coin that comes up “heads” 60% of the time and “tails” 40% of the time. You will keep flipping the coin until you either get three “heads” in a row or two “tails” in a row, at which point you will stop. What is the probability that you will end with three “heads” in a row?

**CCML Video Contest Rubric**

Team Name: _____ Contest:_____ Year:_____

| | | | | |
|---|---|---|---|---|
| **Part (a)** | **0** | **1** | | **2** |
| | • No attempt is made, or the work contains profound errors. | • Problem contains some good work, but also nontrivial errors.<br>• Explanation of work is unclear. | | • Problem contains only trivial errors or no errors.<br>• Explanation of work is clear. |
| **Part (b)** | **0** | **1** | **2** | **3** |
| | • No attempt is made, or the work contains profound errors. | • Problem contains some good work, but also multiple nontrivial errors.<br>• Explanation of work is unclear. | • Problem contains no more than one nontrivial error.<br>• Explanation of work is generally clear. | • Problem contains only trivial errors or no errors.<br>• Explanation of work is clear. |
| **Part (c)** | **0** | **1** | **2** | **3** |
| | • No attempt is made, or the work contains profound errors. | • Problem contains some good work, but also multiple nontrivial errors.<br>• Explanation of work is unclear. | • Problem contains no more than one nontrivial error.<br>• Explanation of work is generally clear. | • Problem contains only trivial errors or no errors.<br>• Explanation of work is clear. |
| **Presentation** | **0** | **1** | | **2** |
| | • Images are sloppy or out of focus.<br>• Audio is difficult to hear. | • Audio/video are clear.<br>• Presentation is organized well | | • Presentation is truly creative and engaging. |

Score: _____ / 10

Notes: