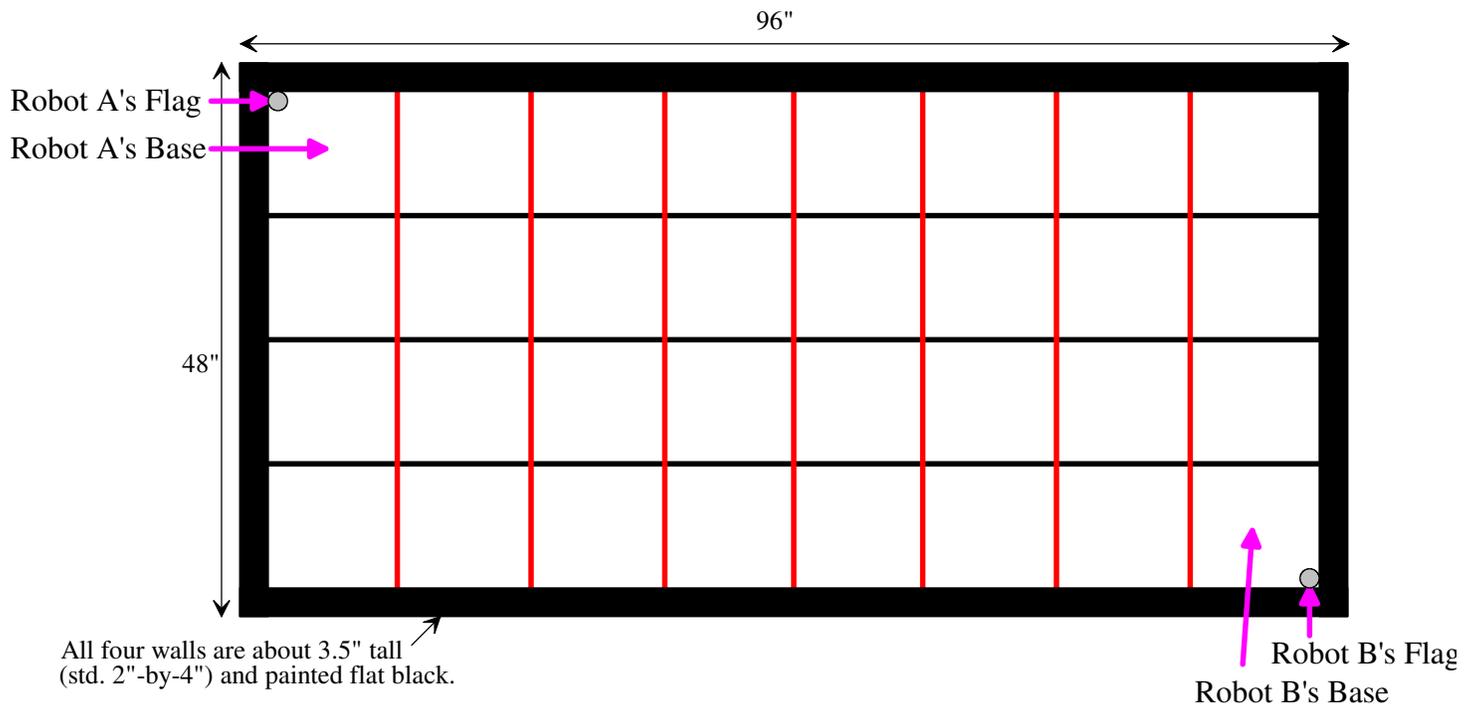


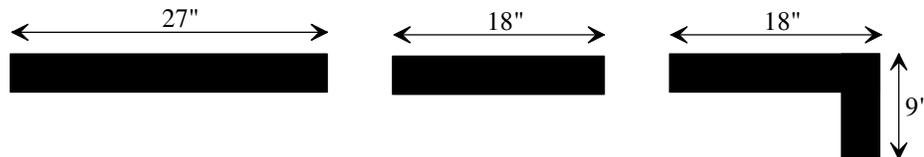
# MICS 2018 Robotics Contest: Capture-the-Flag

The MICS 2018 robot contest will be a capture-the-flag tournament. Each match will consist of two robots playing capture-the-flag in a grid-world. A robot's goal in a match is to retrieve the opponent's flag from their base and return the flag back to its own base. The grid-world will be made from a 4' x 8' sheet of plywood completely enclosed by black walls made of 2"-by-4" lumber (so they are about 3.5" tall). On top of the plywood will be a 0.25" white prefinished melamine panel (to aid in transporting this panel will be cut into two halves). Three parallel lines of black 0.75" vinyl electrical tape will be evenly spaced between the long-sided walls. Seven parallel lines of red 0.75" vinyl electrical tape will be evenly spaced between the short-sided walls (the red tape lines will cross over the black tape). A sample grid-world without obstacles is shown below.

Robots will start in opposite corners of the world in their own base. In the outside corner of their base will be their flag. A robot's task is to cross to the opponent's base, capture their flag, and return it to their own base first. Robots will have at most 3 minute to capture their opponent's flag and return it to their base. Navigation of the grid-world will be complicated by two obstacles randomly placed within the grid-world by the judges.



**Obstacle Shapes:** Each hole has between 1 to 3 obstacles.



Obstacles will be painted flat-black and made from 4"x 4" lumber (or two 2-by-4's screwed together). Obstacle shapes are shown on the left side of the diagram. The obstacles will be oriented such that the 4" lumber is centered on grid lines. Bases will be reachable by at least one side.

The white panels used for the grid surface are available at:

Dakota™ 1/4" x 49" x 97" Melamine Panel (cut as described above) Model Number: MEL1\_449PBwhite,

Menards® SKU: 1362171 Variation: White available on-line at:

<https://www.menards.com/main/building-materials/panel-products/specialty-panels/prefinished-panels/dakota-trade-1-4-x-49-x-97-melamine-panel/p-1444428246997-c-13335.htm?tid=-5993777466929659186&ipos=5>

### **The Winner:**

1. The robot successfully capturing the opponent's flag and returning it to their home base in the shortest time is the winner of the match. A tournament of matches will be used to determine the overall winner.
2. If neither robot successfully accomplishes (1), then the robot at the end of the match coming closest to satisfying (1) is the winner. Some examples are needed to help explain the meaning of "coming closest":
  - a. If robot A captures (holding or pushing) their opponent's flag and robot B does not, then robot A wins.
  - b. If both robots capture their opponent's flags, then the robot nearest ("as the crow flies" -- ignoring obstacles) to their home base is the winner.
  - c. If neither robot captures their opponent's flag, then the robot nearest ("as the crow flies" -- ignoring obstacles) to their opponent's base is the winner.

**Only the final state of the world when time expires is considered in (2).** If a robot captures its opponent's flag and loses it, then it has not captured the flag. The robot must be holding or pushing the flag when time expires to have captured it.

### **Additional Rules:**

1. Each robot must be fully autonomous, i.e., no communication to an external computer or human operator.
2. The maximum size of a robot in its start configuration is 12" by 12" by 18" (vertical). After a match starts, a robot may exceed these dimensions.
3. A robot which, as determined by the judges, intentionally damages the playing field or opponent's robot in any fashion will be disqualified immediately. This includes leaving any "trail of bread crumbs," or mark its path in any way. Once a robot is disqualified, the robot shall not be permitted to engage in any additional matches. Pushing on obstacles or the opponent's robot is allowed.
4. At any point during a match, a team can decide to restart their robot from their base, but the clock will continue to run. If the robot has captured the opponent's flag, the flag will be returned to its original location in the opponent's base. The robot must be restarted with the same program being run.
5. A robot should not hold or move their own flag. At any point during a match, a team can request the judge return their opponent's flag to its original location in the outside corner of the opponent's base.
6. Robots may NOT be reprogrammed or physically modified between matches. The robot must run the same program when restarted during a match, but any knowledge about the grid-world obtained before it was restarted **can** be retained. The only allowed repair is changing batteries or those necessary to return a robot its original configuration, and these must not result in a delay of the competition.
7. Before the competition starts, all robots must be checked in **and be left with the judges.**
8. Matches are started using the following sequence of events:
  - a) teams position their robots such that at least one wheel is touching their base
  - b) the judge positions the obstacles
  - c) the judges says "Ready, Set, Go"
  - d) teams start their robots immediately after the judge says "Go"
9. Any robot that violates the spirit of the contest rules, in the judgment of the organizers, will be eliminated from competition. All decisions by the judges are final!
10. An enlarged picture of the flag is shown below. Flags are constructed from three lego pieces and a steel washer:
  - gray Technic Gear 40-teeth, part #: 4285634 (or 3649)
  - gray Technic Crown Gear 24-teeth, part #: 4211434 (or 3650b)
  - black Technic Axle length 6, part #: 370626 (or 3706)
  - 3/16" x 1" zinc plated, steel Fender washer (3/16" hole, 1" diameter washer)

Note: The washer will be free to move on the axle.

