# Robotics 23/02/2015

Full Name _____

**Question 1.** Explain shortly the working principle of the thermocouple.

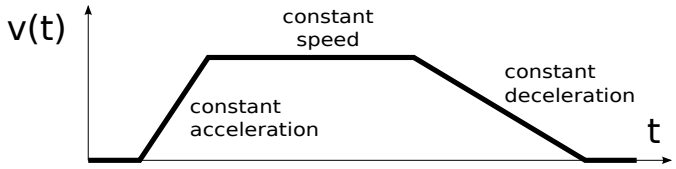
**Question 2.** Design a finite state machine implementing the navigation of a mobile robot based on a cell decomposition map of an environment populated by trapezoidal-shaped obstacles. Assume that the list of waypoints from the start to the goal point is known. In the answer, please draw an example of cell decomposition.
Inputs are:

- the GPS sensor, which provides the 2D position of the robot;
- the compass, providing the heading of the robot;
- a speedometer, which measures the robot's current velocity.

Available outputs are the following:

- an `accelerate()` command that makes the robot's speed to increase at constant rate;
- a `brake()` command that makes the robot's speed to decrease at constant rate;
- a `rotate()` command, which makes the robot to slightly turn left or right.

The velocity profile of a typical linear movement is as follows:




Make further adequate assumptions if needed.
**Hint**: focus on the logic of the navigation algorithm, making assumptions to simplify the robot control during the motion. E.g., you can assume that, when moving, there is no drift, i.e., when pointing in one direction, such a direction is followed with no drift.

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**Question 3.** Consider a task set composed by 2 periodic tasks. Tasks are described by the tuple (T, C), being the period and the computation time, respectively. The values of timing parameters are: T1 = (7, 2), T2 = (11, 3). Perform the following actions:

- check the schedulability of the task set applying the tests for RM and EDF;
- draw the schedule generated by RM and EDF up to time t = 45 or to the first deadline miss.

Suppose to add a Sporadic Server (SS) to manage aperiodic tasks. The SS has period and budget equal to 15 and 3, respectively.
Draw the schedule where the SS is used to accomodate two aperiodic tasks J1 and J2 together with the periodic task set, using the appropriate scheduling algorithm for periodic tasks. The two aperiodic tasks have parameters equal to J1 = (4, 2) and J2 = (9, 4), where the first value is the release time while the second is the computation time.

**Question 4.** Plot the path generated by the Tangent Bug in the following two cases: