Robotics 10/09/2014

Full Name _____

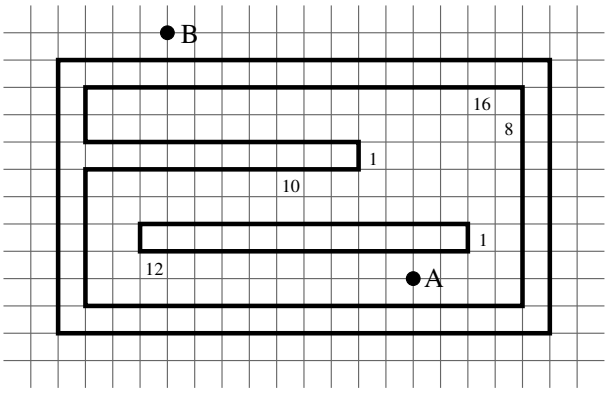
Question 1. Shortly explain the problem related to the energy supply in robotics systems.

Question 2. What is and how does it work the structural compensation based on unbalanced T in MEMS accelerometers?

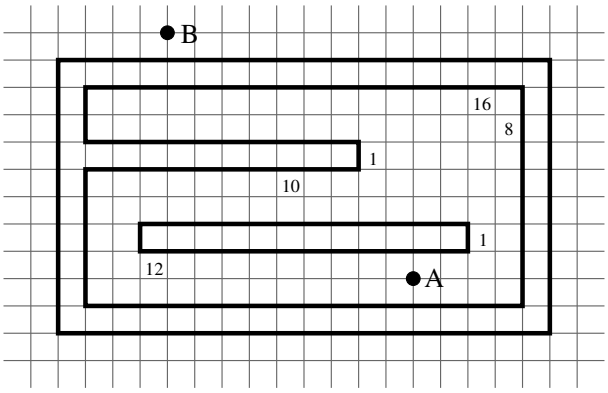
Question 3. Describe the working principle of the thermocouple.

Question 4. Show the path generated by Bug 1 and Bug 2 within the following configuration space in the worst case of possible choices. Determine the length of the travelled distance and clearly show the point where the algorithm stops its execution.

Bug 1



Bug 2



Question 5. A task set is composed by the following 3 tasks: $\tau_1 = (8, 5, 3)$, $\tau_2 = (7, 7, 2)$ e $\tau_3 = (6, 3, 1)$, where the three values indicate the period T_i, the relative deadline D_i and the WCET C_i, respectively. Given the task set, satisfy the following requests:

1. draw the schedule generated by EDF and RM up to t = 45;
2. tell what can be said about the schedulability of the task set by analysing the utilization of the system;
3. reply to the same question as of point 2 assuming that $T_i = D_i$ for all tasks.

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Question 6. Design a Finite State Machine (FSM) that controls the 4 traffic lights in the intersection below (figure). In each lane there is a sensor of presence (S1, S2, S3 and S4) that tells whether a car is over it or not. These sensors are used to detect if a car is waiting while the red light is on. Traffic lights must be operated such that T1 and T3 always shows the same color, as well as T2 and T4. Obviously, adjacent traffic lights (e.g. T1 and T2) must not show the green light at the same time. Moreover, since one street is usually more busy than the other, the green light of the busy street must stay on until no cars are waiting on the other side. It is required that the maximum waiting time for a car in front of a red light is 1 minute.
List carefully inputs, outputs and additional hypothesis if needed.