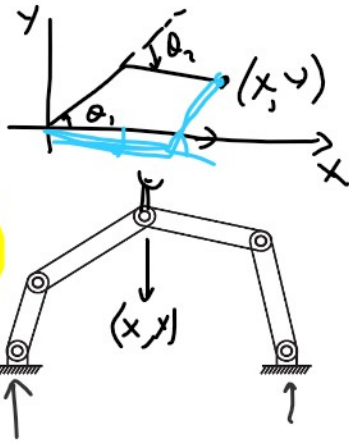
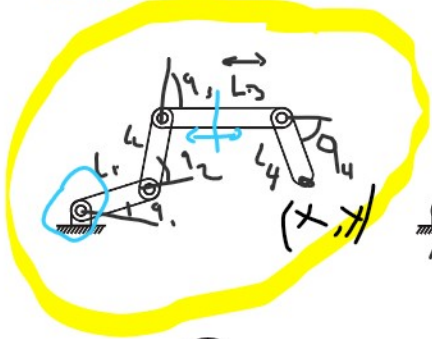


ΚΙΝΗΣΗ ΡΟΜΠΟΤΙΚΟΥ ΒΡΑΧΙΟΝΑ

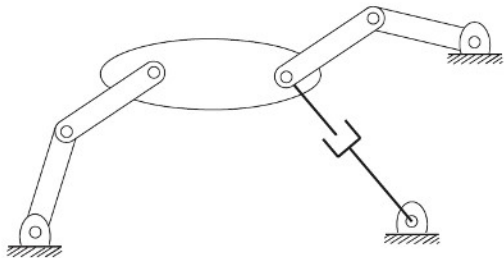
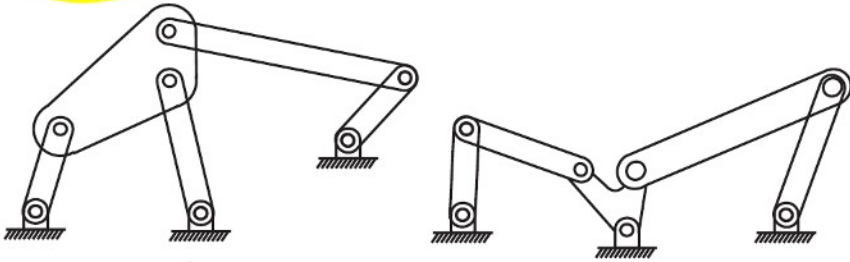


ΑΡΧΙΖΟΥΜΕ
11:15

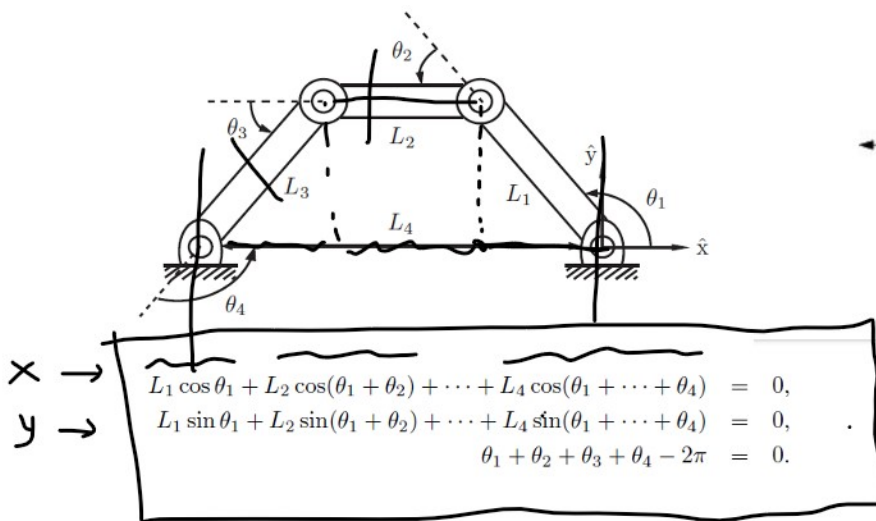
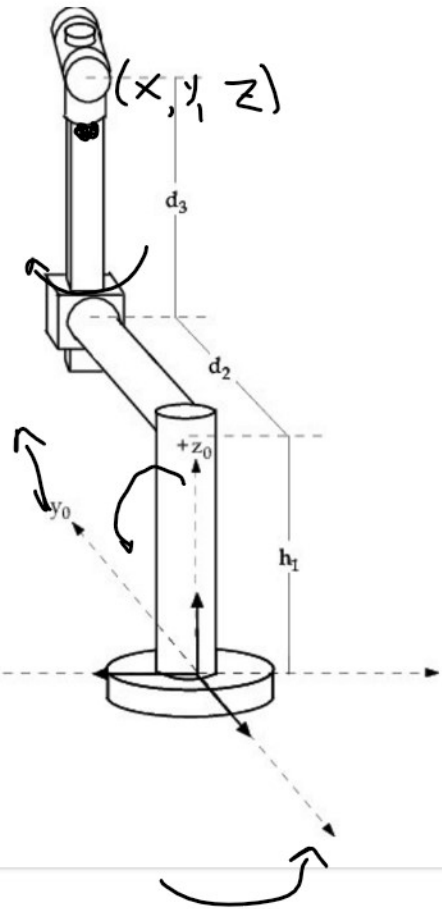
$$y = f(x)$$

$$(x, y) = f(q_1, q_2, q_3, q_4)$$

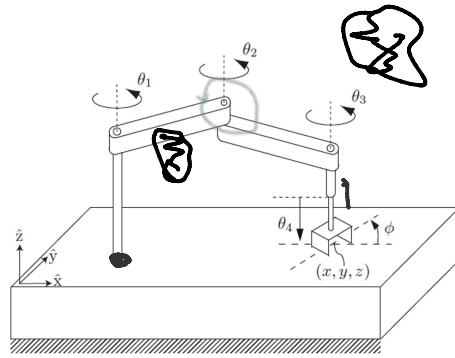
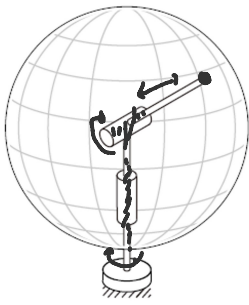
↙
↑



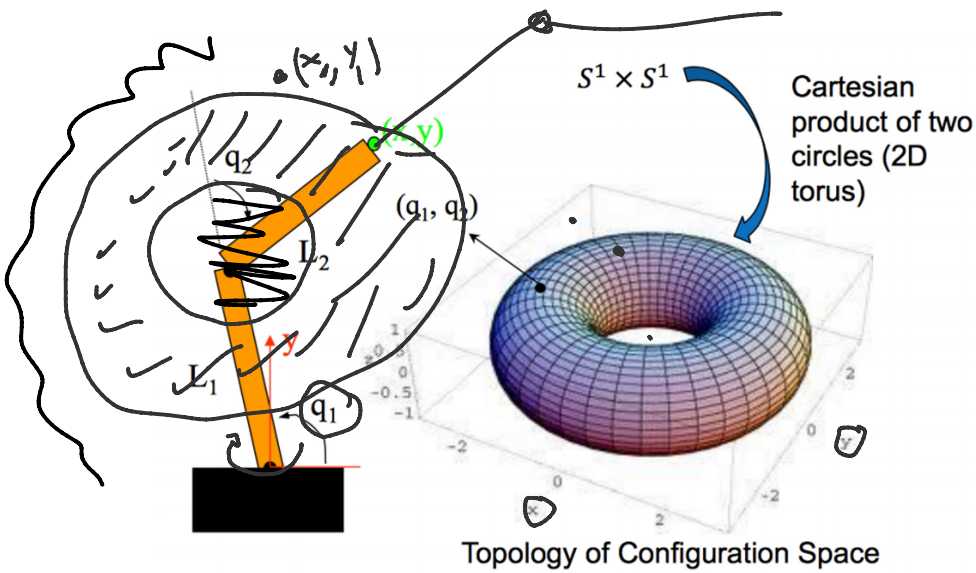
ΒΑΘΜΟΙ ΕΛΕΥΘΕΡΙΑΣ ΡΟΜΠΟΤΙΚΟΥ ΒΡΑΧΙΟΝΑ



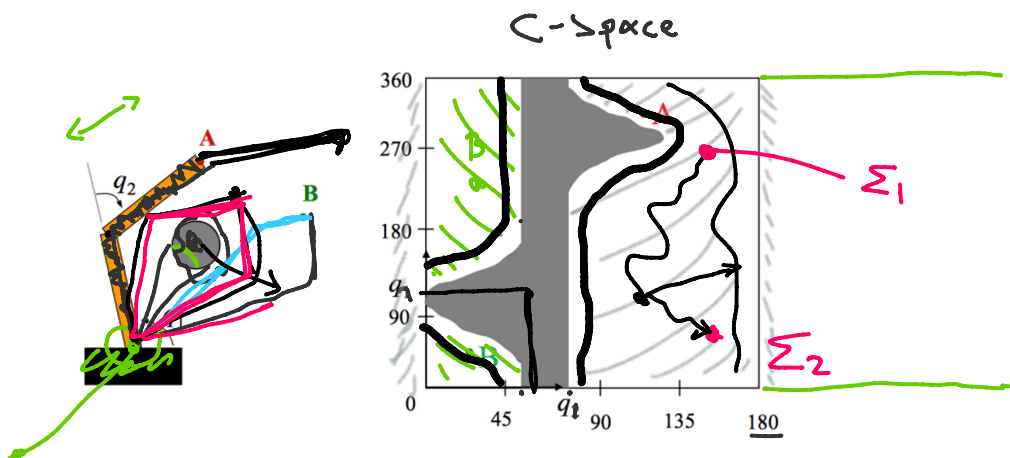
$$\begin{aligned} x \rightarrow & L_1 \cos \theta_1 + L_2 \cos(\theta_1 + \theta_2) + \dots + L_4 \cos(\theta_1 + \dots + \theta_4) = 0, \\ y \rightarrow & L_1 \sin \theta_1 + L_2 \sin(\theta_1 + \theta_2) + \dots + L_4 \sin(\theta_1 + \dots + \theta_4) = 0, \\ & \theta_1 + \theta_2 + \theta_3 + \theta_4 - 2\pi = 0. \end{aligned}$$



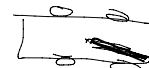
ΧΩΡΟΣ ΕΡΓΑΣΙΑΣ - Configuration Space - C Space



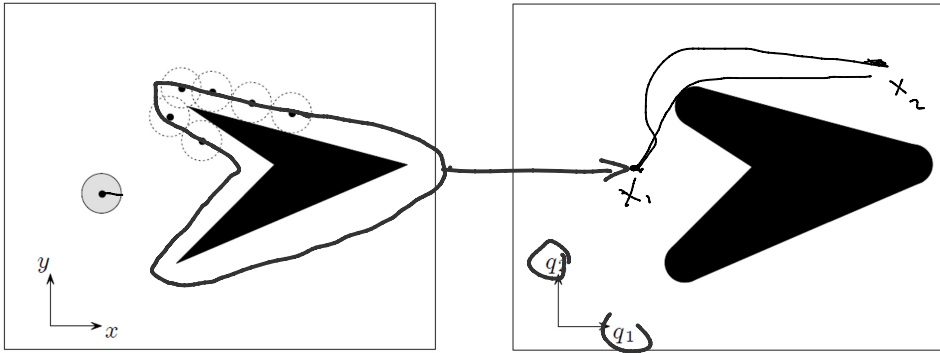
ΕΜΠΟΔΙΑ ΣΤΟΝ ΧΩΡΟ ΕΡΓΑΣΙΑΣ



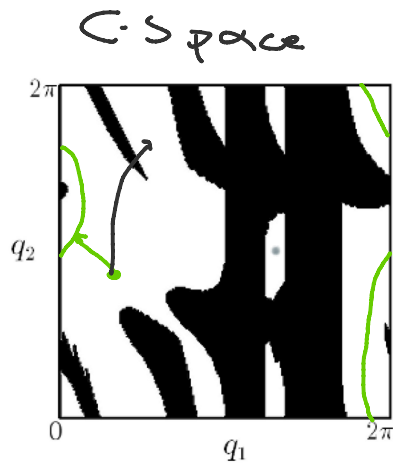
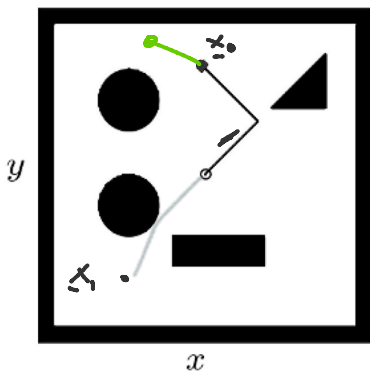
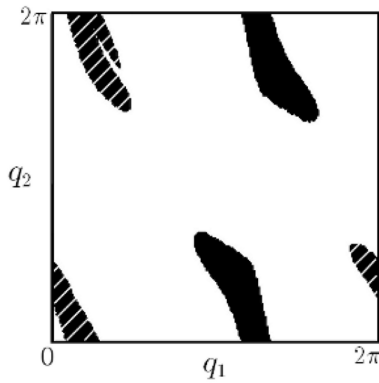
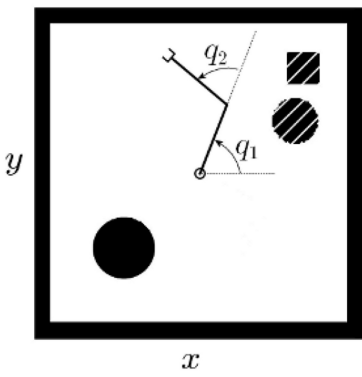
<https://robotics.cs.uno.edu/C-space/>



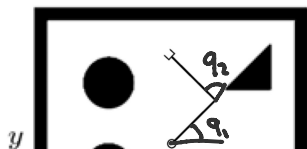
Τι γίνεται με τις πραγματικές διαστάσεις των ρομποτικών βραχιόνων;

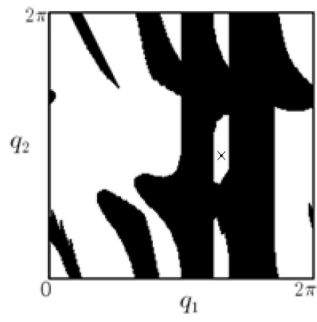
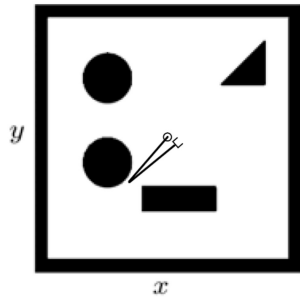
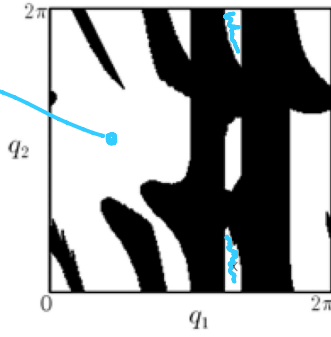
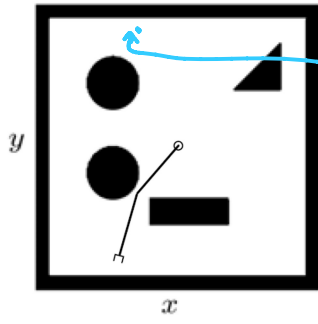
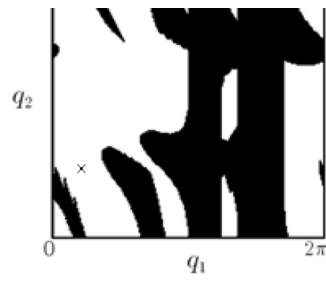
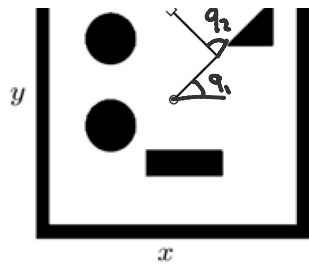


Παραδείγματα ρομποτικών βραχιόνων

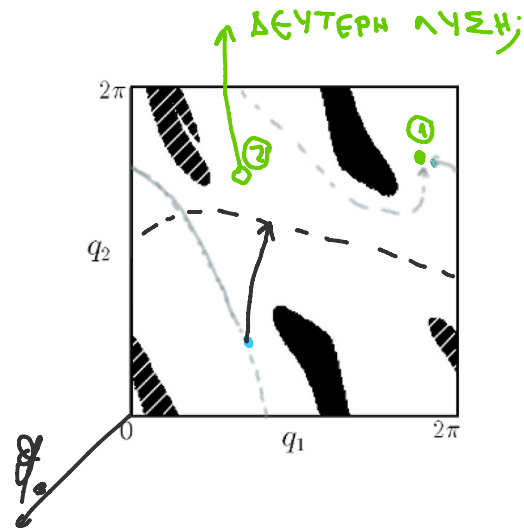
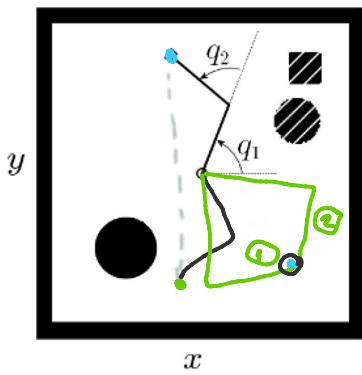


Χώρος πιθανών θέσεων στον C-space

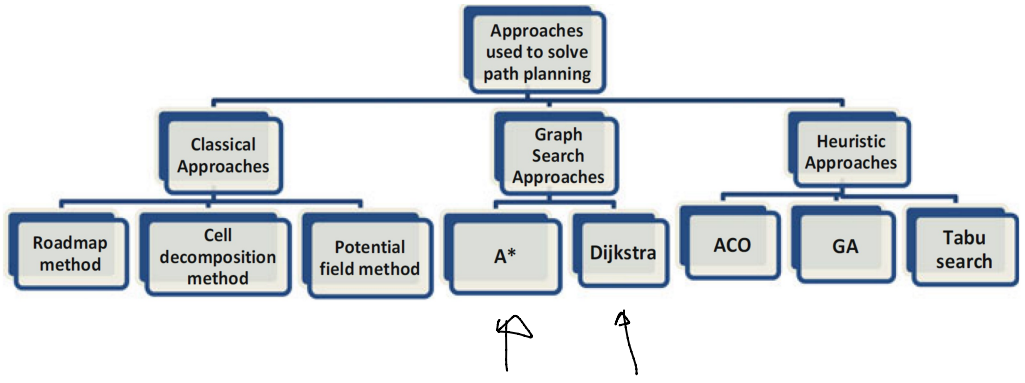




Σχεδιασμός τροχιάς στον C-space



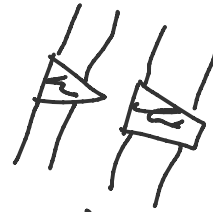
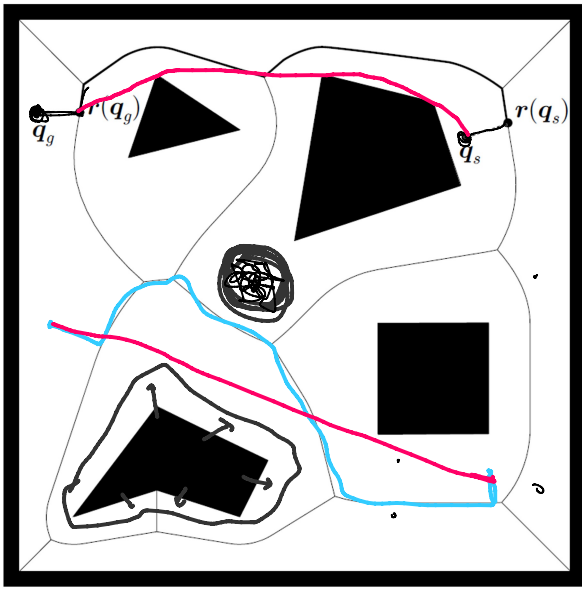
ΔΕΥΤΕΡΗ ΛΥΣΗ;



The roadmap approach

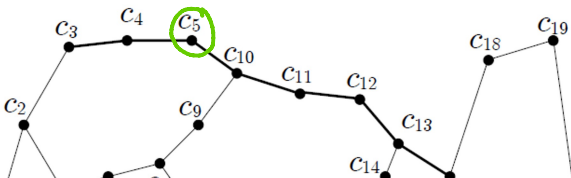
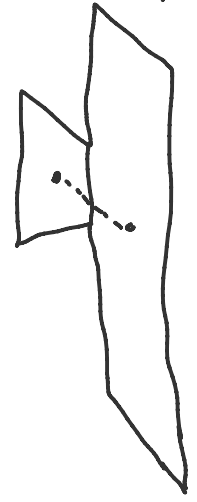
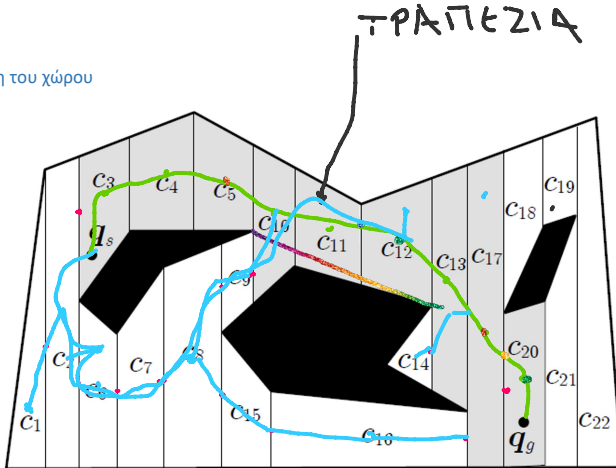
"Ασφαλής" οδήγηση στο C-space

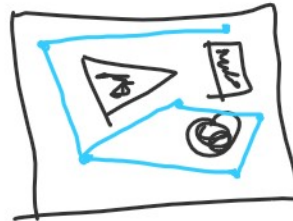
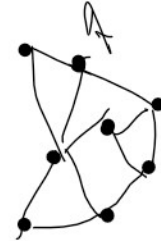
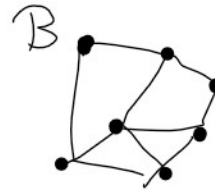
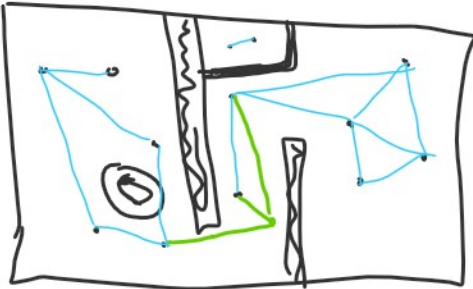
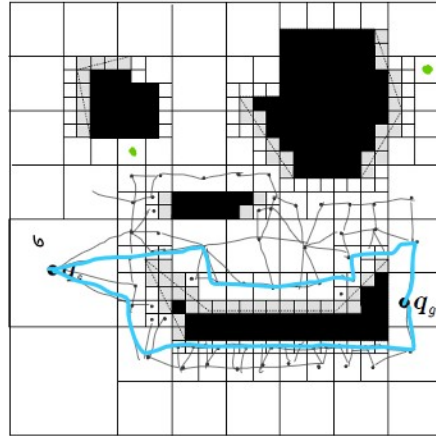
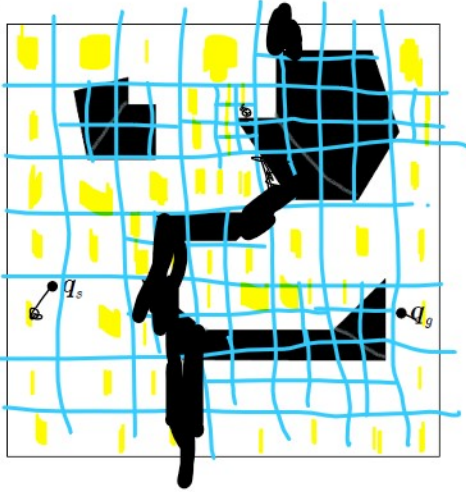
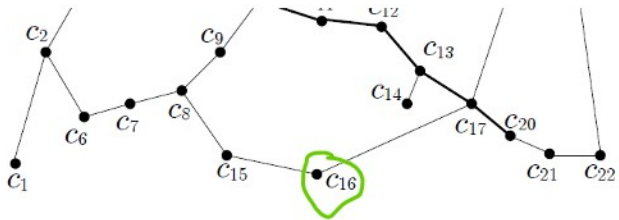
Γνωρίζω a-priori τα μονοπάτια.
Πως τα σχεδιάζω;



The cell decomposition approach

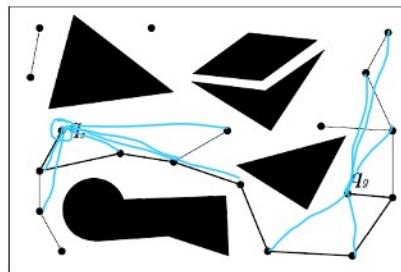
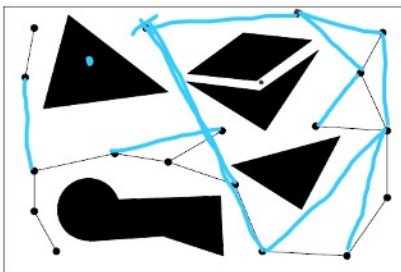
Διαμέριση του χώρου

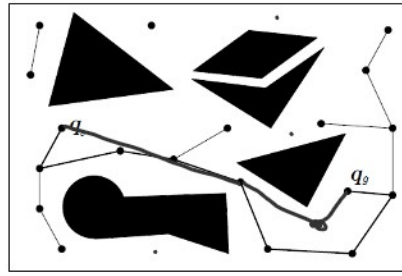
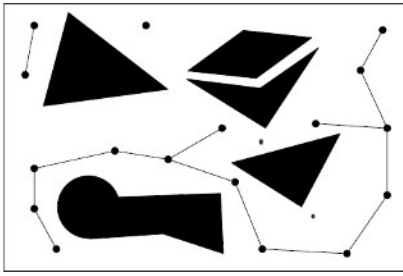




Στοχαστικές μέθοδοι

PRM (Probabilistic Roadmap) method:
Επιλέγονται Τυχαία σημεία στον χώρο και ελέγχεται αν η μεταξύ τους ευθείες συναντούν εμπόδια





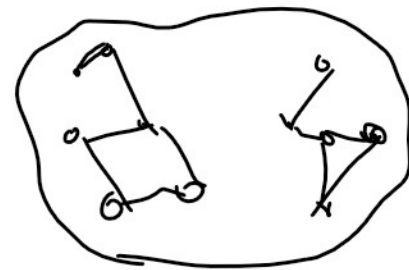
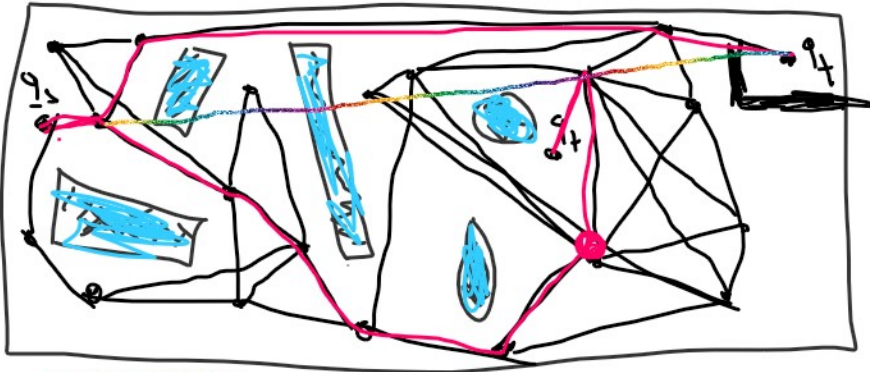
↓
ΘΕΩΡΙΑ ΓΡΑΦΩΝ

ΑΡΧΙΖΟΥΜΕ

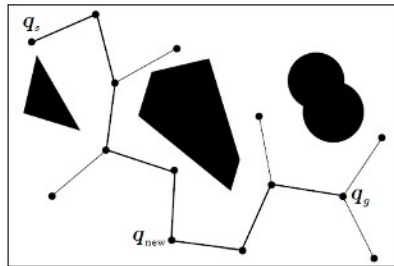
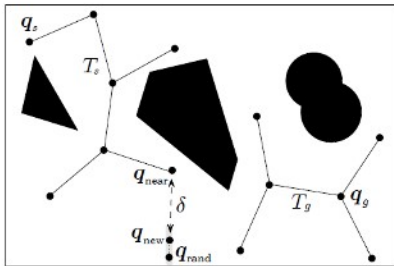
Rapidly-exploring Random Tree RRT Method Δημιουργεί τυχαία ένα δέντρο που γεμίζει χώρο.

Από τυχαίο σημείο βρίσκεται ο πλησιέστερος κόμβος του δένδρου.

11:15

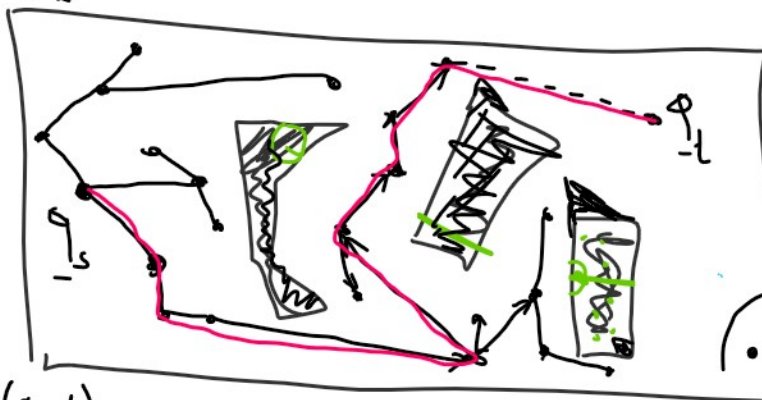


Bidirectional RRT Method



y_{max}

$(0, x_{max})$ $(0, y_{max})$



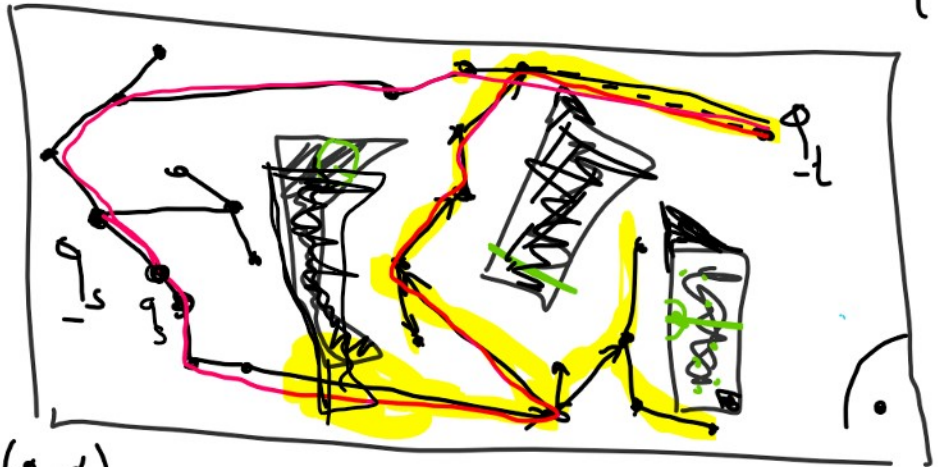
2 4

$(0, 0)$

x_{max}

y_{max}

$(0, x_{max})$ $(0, y_{max})$

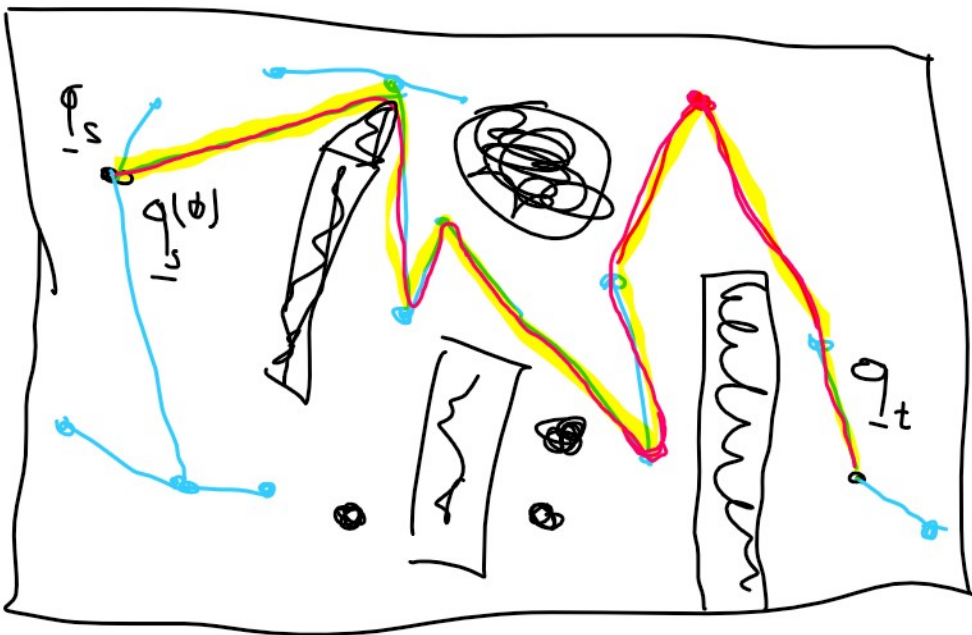


$(0, \phi)$

x_{max}

2

4



$$\begin{pmatrix} q_x(t) \\ q_y(t) \end{pmatrix}$$

