Problem 1a

Consider a snake attempting to segment a circular object as shown below. Associate the correct description (A,B,C,D) of the energy terms of the snake with each of the figures (1,2,3,4). (4p)

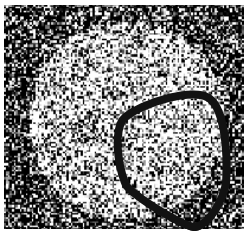	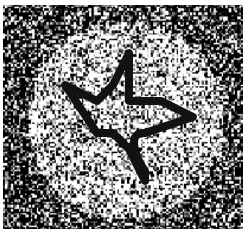		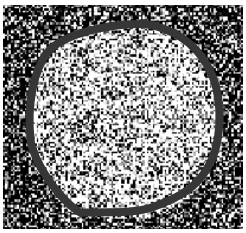
Figure 1.	Figure 2.	Figure 3.	Figure 4.

A. high-internal energy & low-external energy
B. high-internal energy & high-external energy
C. low-internal energy & low-external energy
D. low-internal energy & high-external energy

Problem 1b

Let $\mathbf{v}_i(t) = (x_i(t), y_i(t))$ be the snake nodes where $i = 1,2,\mathrm{K},N$, and $I_s(x,y)$ is a smoothed version of the image. Associate the correct force effect (a,b,c) and force equation (I,II,III) with each of the following forces (1,2,3). (3p)

$\mathbf{F}_i^{flexural}(t)$: tensile force	$\mathbf{F}_i^{tensile}(t)$: flexural force	$\mathbf{F}_i^{external}(t)$: external force
Force 1.	Force 2.	Force 3.

a. Pulls the snake towards edges in the image
b. Resists stretching in the snake
c. Resists bending in the snake

I. $2\mathbf{v}_i(t) - \mathbf{v}_{i-1}(t) - \mathbf{v}_{i+1}(t)$
II. $\tilde{N}(-\|\tilde{N}I_s(x,y)\|)$
III. $6\mathbf{v}_i(t) - 4\mathbf{v}_{i-1}(t) - 4\mathbf{v}_{i+1}(t) + \mathbf{v}_{i-2}(t) + \mathbf{v}_{i+2}(t)$

Problem 1c

Describe the main steps of the Canny edge detection algorithm. (3p)

Solutions

1a) 1 – D
2 – B
3 – A
4 – C

2b) Force 1 – b – I
Force 2 – c – III
Force 3 – a – II

3b) See lecture notes