



• Answer all the following questions	• Duration: 3 Hours
• Illustrate your answers with sketches when necessary	• No of questions : <u>6</u> in <u>2</u> pages
• Assume any missing data	• Total Marks: 90 Marks

Q1. Given a stereo pair of scanned 23 cm by 23 cm aerial images that have 68% overlap and 900 dpi resolution. Two points (p') and (q') appears on the right image where $x_{p'} = -79.64$ mm, $x_{q'} = +10.12$ mm and $y_{p'} = y_{q'} = 0$. Calculate the approximate pixel coordinates of its conjugate (p) and (q) in left image pixel coordinate system. Assume that photo coordinate system has its origin at image center and is parallel to the pixel coordinate system. (15 marks)

Q2. Given that the array A is a template and B is its matching window in the search space. Compute the optimum sub-pixel position of the template with respect to the matching window using the technique of least-squares matching, ignoring the radiometric differences between the two windows. What if radiometric differences are considered? (15 marks)

$$A = \begin{bmatrix} 38 & 55 & 40 \\ 53 & 58 & 53 \\ 40 & 55 & 38 \end{bmatrix} \qquad B = \begin{bmatrix} 52 & 66 & 53 \\ 64 & 69 & 64 \\ 51 & 67 & 50 \end{bmatrix}$$

Q3. Referring to the 4x4 patch of a digital image given below, use the bilinear interpolation method to compute the interpolated value at the fractional locations (r=817.24, c=547.44) and (r=819.38, c=545.66). (15 marks)

	c:545	c:546	c:547	c:548
r:817	68	64	72	79
r:818	64	71	78	74
r:819	61	65	71	78
r:820	63	56	62	68

Q4. Assume having a stereo-pair of digital images with Image size of 2200 pixel by 2200 pixel and pixel size of 0.1 mm. Camera inner orientation elements are $x_o=0.005$ mm, $y_o=0.004$ mm and $f=153.120$ mm. A point P is one of the DEM points generated from the stereo-pair. Its 3-D ground coordinates are $X_P = 710$ m , $Y_P = 670$ m and $Z_P = 80$ m. Calculate the coordinates of the point in the pixel coordinate system of the left image that has $\omega=\phi=\kappa=0$, $X_L= 340$ m , $Y_L= 260$ m and $Z_L= 970$ m. (15 marks)

Q5. Apply Förstner and Moravec operators on the following window. Show the obtained results in each case. (15 marks)

9	13	5	10	13
12	17	12	9	8
11	24	10	8	11
9	15	13	15	14
12	18	17	20	19

Q6. Apply Binomial filter and Sobel operator to the window given in Q5. Show the obtained results in each case. (15 marks)

Best Wishes

Prof. Dr. Mohamed Zahran and
Board of Examiners