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University of Regina
Department of Computer Science
CS425-001 Assignment 1 (23 Marks)
Due Tuesday, October 1, 2013, 11:30AM
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1. Please be sure to **show** all of your **work** for problems involving computations.

2. Programming problems may be written and compiled in either **C**, **C++**, **C#** or **Java**, but **not MATLAB**. As well, please hand in **well-documented** source code of your programs, along with any required **output** images.

Non-Programming Problems

(3 Marks)

1. Assuming that $V = \{0, 1, 2\}$, find the **shortest** 4-, 8- and m- paths between p and q in the image of Figure 1. If a particular path does **not** exist between p and q, then **briefly explain** why not.

$$
\begin{array}{ccccccc}
(p)\ \ 0 & 2 & 1 & 3 & 6 & 4 & 8 \\
5 & 4 & 5 & 0 & 2 & 0 & 0 \\
5 & 1 & 0 & 2 & 8 & 3 & 6 \\
8 & 2 & 0 & 7 & 1 & 0 & 2\ \ (q) \\
1 & 0 & 9 & 0 & 0 & 2 & 4 \\
2 & 7 & 3 & 3 & 1 & 2 & 5 \\
\end{array}
$$

<div align="center">Figure 1</div>

Programming Problems

$(10 + 10 = 20$ Marks$)$

1. Write a program to create a **map**, composed of **uniform** 8×8 blocks, of the **level-of-detail** of an image. The level-of-detail of a given block, shaded **dark** in low-detail regions and **bright** in high-detail regions, collectively over the interval $[0, 255]$, is taken to be the **maximum** of the individual **differences** of each **pair** of pixels in a given block. Test your program using the "hats", "window" and "stream" images available on the course homepage. Your submission should include print outs of the maps.

2. Write a program to create a 511×511 image of the **surface** given by the function

$$f(x) = 1 - \sin \sqrt{x^2 + y^2},$$

where the domain of $f(x)$ is $x, y \in [-\infty, \infty]$ and the range of $f(x)$ is $f(x) \in [0, 1]$. The surface, **centered** in the image and **filling** the entire image, should be **sampled** over the domain $x, y \in [-\pi/2, \pi/2]$. The range should be extended to $f(x) \in [0, 255]$, where the **brightest** value occurs at the **center** of the image, while the **darkest** values occur near the **boundaries** of the image. Your submission should include a print out of the surface image.