Name:
Student number:

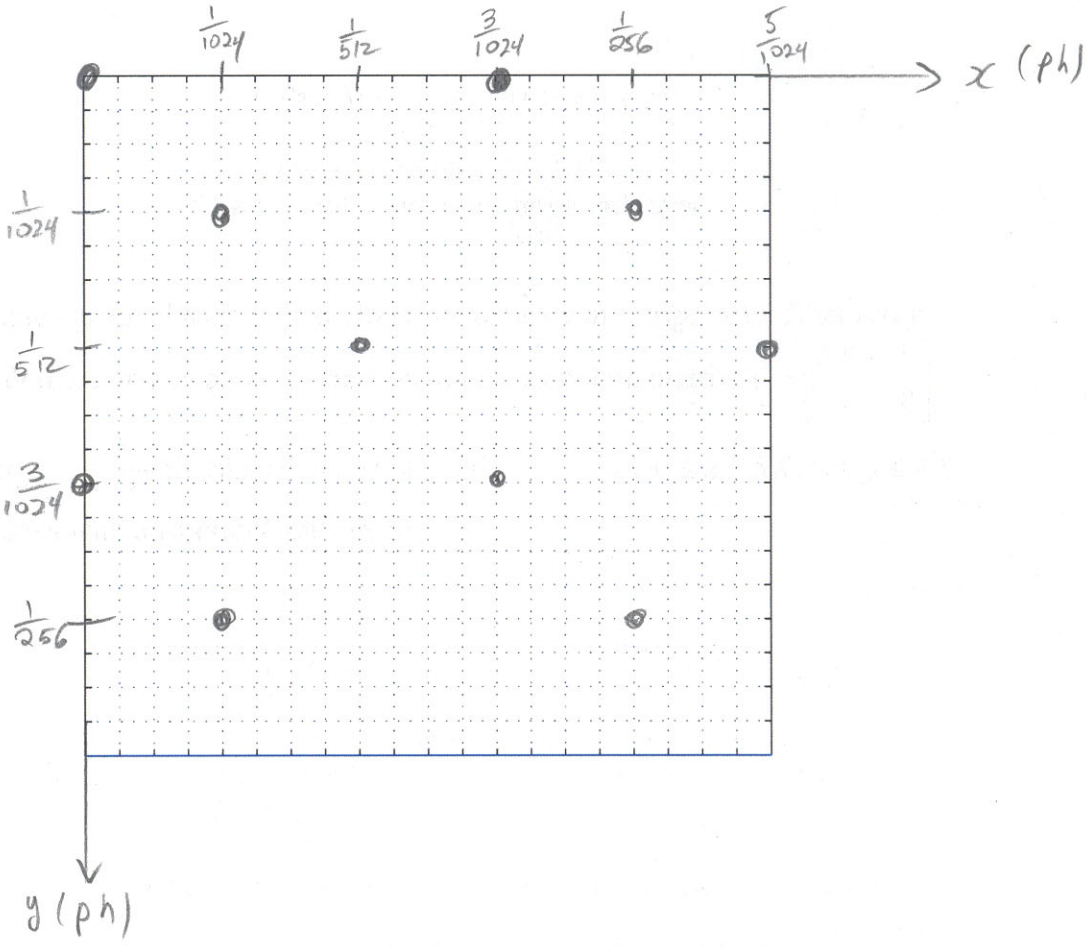
CEG4311 Image Processing
Fall 2007
Quiz 1, October 24, 2007
Closed book – no notes or calculators

Question:

(a) The sampled green channel of a digital camera using the *stripe* color filter array $f_G[x, y]$ is defined on the lattice Λ specified by the sampling matrix $\mathbf{V} = \begin{bmatrix} 3X & X \\ 0 & X \end{bmatrix}$.

Assume that $X = \frac{1}{1024}$ ph. Sketch the points of the lattice for $0 \le x \le 5X, 0 \le y \le 4X$.

Label your axes with ***numerical*** units in ph.



use other side if needed

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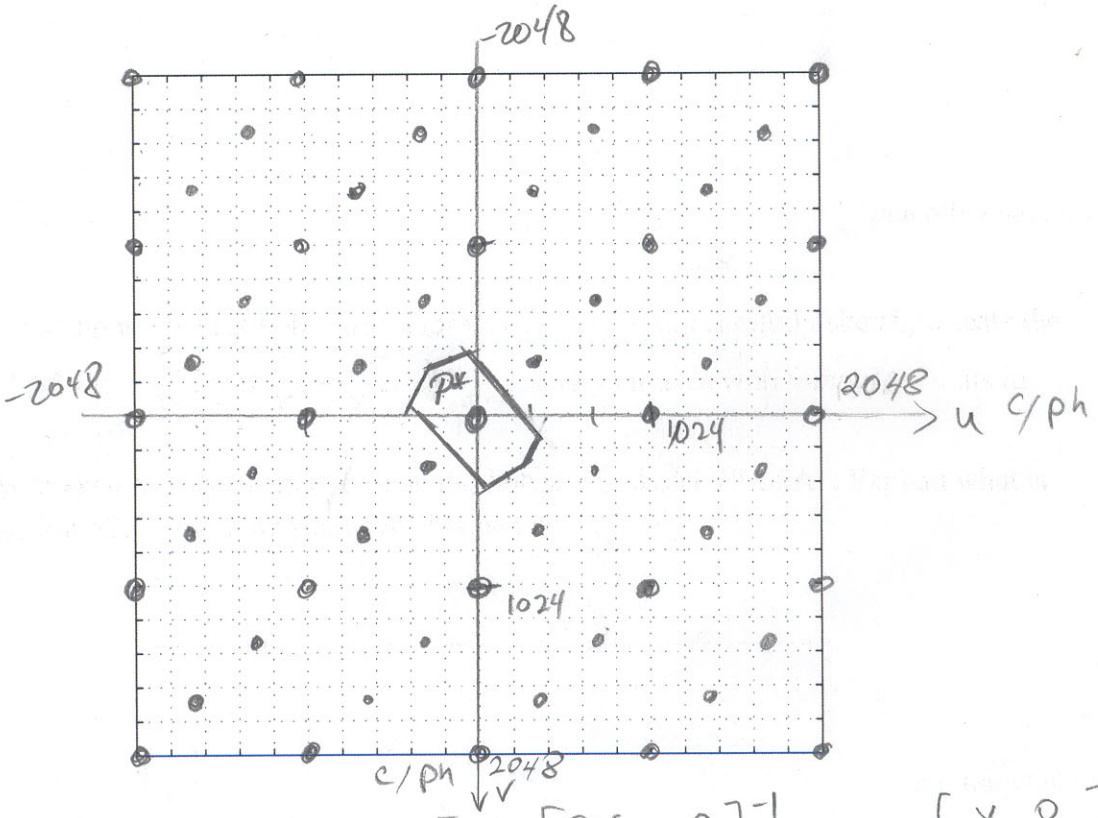
Change to $\frac{1}{X}$

(b) Find a sampling matrix **U** for the reciprocal lattice Λ^* and carefully sketch to scale the points of Λ^* for $-\frac{2}{X} \le u \le \frac{2}{X}, -\frac{2}{X} \le v \le \frac{2}{X}$. Label your axes with ***numerical*** units in c/ph.

(c) On your sketch of (b), sketch to scale the *Voronoi* unit cell $\mathcal{P}^*$ of Λ^*. Explain what is the definition of $\mathcal{P}^*$ and how you have obtained it.



$\Lambda^* = LAT(V^{-T})$ $\quad U = V^{-T} = \begin{bmatrix} 3X & 0 \\ X & X \end{bmatrix}^{-1} = \frac{1}{3X^2}\begin{bmatrix} X & 0 \\ -X & 3X \end{bmatrix}$

$= \begin{bmatrix} \frac{1}{3X} & 0 \\ -\frac{1}{3X} & \frac{1}{X} \end{bmatrix}$

$\mathcal{P}^*$: all points closer to (0,0) than any other element of Λ^*.

use other side if needed