LO1] a] $2^{175} \bmod 127$

$\Rightarrow 2^7 = 128$

$128 \equiv 1 \bmod 127$

$\Rightarrow 2^7 \equiv 1 \bmod 127$

$\because \frac{175}{7} = 25$

$\Rightarrow 2^{7 \times 25} \equiv 1 \bmod 127$

$\therefore 2^{127} \bmod 127 = 1$

b] $a^{\frac{n-1}{2}} = \frac{a}{n} \bmod n$

$\Rightarrow 2^4 = \frac{2}{4} \bmod 4$

$\Rightarrow LHS = 2^4 \bmod 4$

$= 16 \bmod 4 = \underline{\underline{1}}$

$RHS = \frac{\cancel{2}}{\cancel{4}} = \frac{1}{2} = 1$

$\therefore LHS = RHS$

a is an accomplice to 5 being prime.

[Q2] a] $n^{\log_b a} = n^{\log_3 8}$

$f(n) = n^{\log_3 7}$

$\therefore n^{\log_3 8} > n^{\log_3 7}$

$\therefore$ case 1 $\Rightarrow f(n) = O(n^{\log_b a - \epsilon})$

$\therefore \epsilon = n^{\log_3 8} - n^{\log_3 7}$

$T(n) = \Theta(n^{\log_b a}) = \underline{\Theta(n^{\log_3 8})}$

b] Refer to midterm 1 Question 2.
Pink Paper.

LO3] a] Refer to midterm 1 solution Pink Paper

b] 56, 29, 95, 46, 23, 18, 78, 58, 17, 99, 44, 74, 59, 37, 26, 83,
66, 45, 19, 51, 66, 92, 34.

Medians = [46, 58, 44, 51, 66]

Median = 51

Q4] a] The coefficients of P here can be obtained either through the Fast Fourier Transform that is DFT_4 or through the inverse of the fast fourier transform denoted as $IDFT_4$ or DFT_4^{-1}.

b] $DFT(-2, 4, 0, 5)$

$A_e = (-2, 0)$

$= (-2, 2) + (1 \times 0, -1 \times 0)$

$= (-2, -2)$

$\Rightarrow (-2, -2, -2, -2)$

$A_o = (4, 5)$

$= (4, 4) + (1 \times 5, -1 \times 5)$

$= (9, -1)$

$\Rightarrow (9, -1, 9, -1)$

$(-2, -2, -2, -2) + (1 \times 9, -1 \times i, 9 \times -1, -1 \times -i)$

$\Rightarrow (-2, -2, -2, -2) + (9, -i, -9, i)$

$\Rightarrow$ $\underline{(7, -i-2, -11, i-2)}$