CMPT-439 Numerical Computation
Project 11

1. (**25 points**) Design a function HadamardWalsh utilizing the Walsh-Hadamard fast transform algorithm based on the factorization of the Hadamard-Walsh matrix (1) shown in the slides 5-12 of the Lecture 13 class notes
   This function shall be robust and work for any value of *n*, that is for the Hadamard-Walsh transform of order $N = 2^n$.
   It should accept a signal *f* as a calling argument and return its Hadamard-Walsh transform.

2. (**20 points**)Test your function using vectors *f* of lengths 4, 8, 16. To be sure that your function works correctly, find the Hadamard-Walsh transform $s = Hf$ of *f*, and then find the inverse transform $H^{-1}s$ taking into account that $H^{-1} = \frac{1}{N}H$. If everything is correct, you should obtain $H^{-1}s = \frac{1}{N}Hs = f$, that is your initial vector.
   You may assign any numbers as components of *f* or generate random values.

3. (**30 points**) Design a function HadamardWalsh utilizing the Walsh-Hadamard fast transform algorithm based on the factorization of the Hadamard-Walsh matrix (2') shown in the slides 16-24 of the Lecture 13 class notes
   This function shall be robust and work for any value of *n*, that is for the Hadamard-Walsh transform of order $N = 2^n$.
   It should accept a signal *f* as a calling argument and return its Hadamard-Walsh transform.

4. (**20 points**) Test your function using the same vectors, which were used in Task 2 and using the same method (direct and inverse transforms should be performed).

5. (**5 points**). Prepare a report about your results. Turn in your source code and your report.