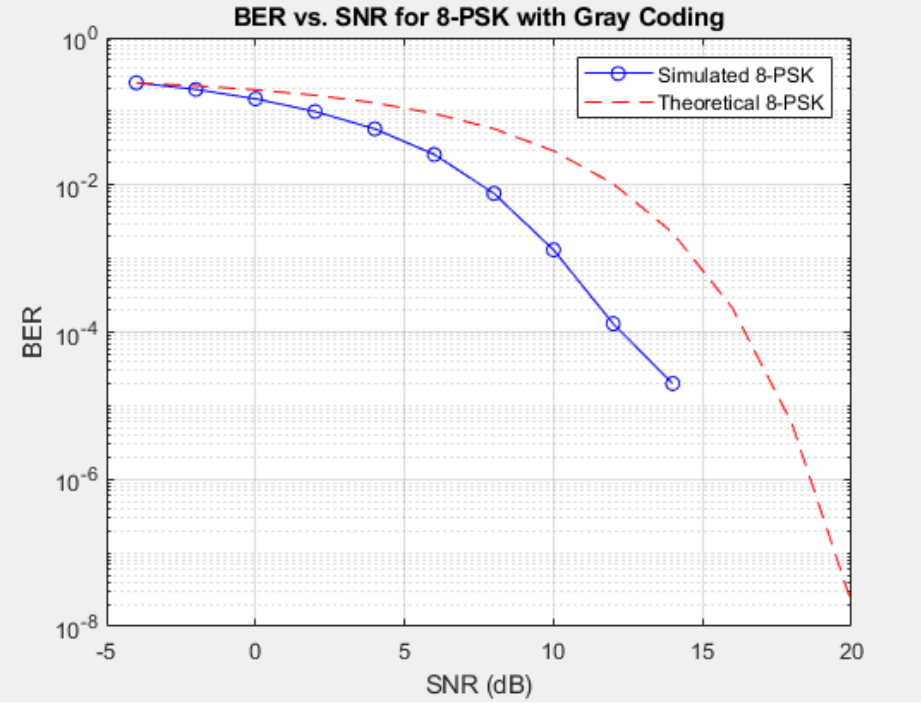
Question 4

After the symbols are transmitted through the channel, the received signal is decoded, and the BER is calculated by comparing the estimated bits with the originally transmitted bits. For each SNR value, the BER is computed and stored in an array.

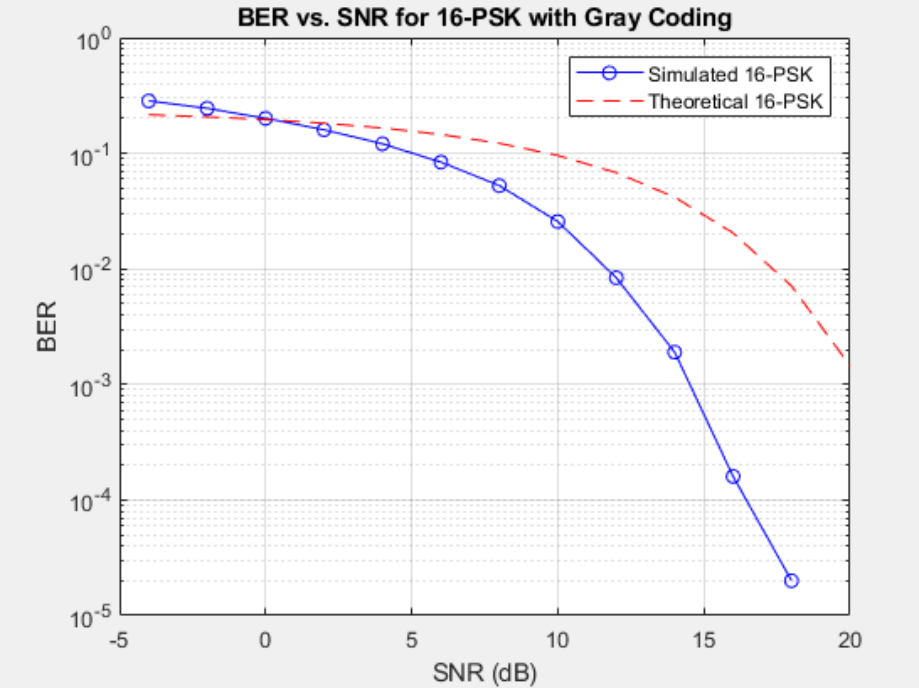
```
    % Calculate Bit Error Rate (BER)
    binary_symbols_detected = gray2binary(detected_symbols, k);
    detected_bits_matrix = de2bi(binary_symbols_detected, k, 'left-
msb');
    estimated_bits = reshape(detected_bits_matrix.', [], 1);
    estimated_bits = estimated_bits(1:Lb);
    num_errors = sum(bits ~= estimated_bits);
    BER_simulated(snr_idx) = num_errors / Lb;

    % Theoretical BER for M-PSK
    BER_theoretical(snr_idx) = (2/k) * qfunc(sqrt(2*SNR) * sin(pi/M));
```

M=8:



M=16:



As expected from theory, 8-PSK has a lower BER for the same SNR. The 16-PSK requires 3 dB more to achieve the same error probability.