ITEC 350
Class Activity - CRC
Solutions

Name:

> **<u>CRC (Cyclic Redundancy Check) Code = Polynomial Code</u>**
>
> Suppose that
>
> (1) $k = 5$, $n-k = 3$,
> (2) Generator polynomial: $g(x) = x^3 + x + 1$
> (3) Information: (1,1,0,0,1)

1. **(2 points) What is the polynomial representation of the binary information vector (1,1,0,0,1) ?**
   $i(x) = x^4 + x^3 + 1$

2. **(8 points) What is the transmitted codeword? You must show the intermediate calculation which leads you to the solution. Show the transmitted codeword in a polynomial representation <u>and</u> a binary vector representation.**
   1) $n-k = 3$, implies multiply $i(x)$ by x^3 to get: $i(x)x^{n-k} = x^3(x^4 + x^3 + 1) = x^7 + x^6 + x^3$
   2) We're given generator polynomial $g(x) = x^3 + x + 1$; Divide it into $i(x)x^{n-k}$

$$
\begin{array}{r l}
 & x^4 + x^3 + x^2 + 1 \qquad\qquad r(x) = x^2 + x + 1 \\
x^3 + x + 1 \,) & x^7 + x^6 + 0 + 0 + x^3 + 0 + 0 + 0 \\
 & \underline{x^7 + x^5 + x^4} \\
 & x^6 + x^5 + x^4 + x^3 \\
 & \underline{x^6 + x^4 + x^3} \\
 & x^5 \\
 & \underline{x^5 + x^3 + x^2} \\
 & x^3 + x^2 \\
 & \underline{x^3 + x + 1} \\
 & x^2 + x + 1
\end{array}
$$

codeword b(x) = $i(x)x^{n-k} + r(x) =$ $\mathbf{x^7 + x^6 + x^3 + x^2 + x + 1}$
as binary vector, b(x) = [1,1,0,0,1,1,1,1]