**BÁO CÁO THỰC HÀNH LAB 2**

**Môn: Thực hành truyền thông số và dữ liệu**

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Câu 1 & 2:

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| data=[1 0 0 1];  addbit = [0 0 0];  bit\_data = [data addbit];  div=[1 0 1 1];  [q,r]=deconv(bit\_data,div);  r = mod(r,2);  tx\_data = bitxor(bit\_data,r) | >> tx\_data  tx\_data =  1 0 0 1 1 1 0 |

Câu 3:

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| rx\_data = bsc(tx\_data,0.2);  [qcheck, rcheck] = deconv(rx\_data,div);  rcheck = mod(rcheck,2);  check = sum(rcheck);  if check ~= 0  disp("Retransmission Required");  else  disp("TRANSMISSION SUCCESSFUL");  end | Retransmission Required  >> tx\_data  tx\_data =  1 0 0 1 1 1 0  >> rx\_data  rx\_data =  1 0 0 1 0 1 0  >> check  check =  1 |

Câu 4 & 5:

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| clear; clc  rng default  M = 64; % Modulation order  k = log2(M); % Bits per symbol  EbNoVec = (1:2:20); % Eb/No values (dB)  numSymPerFrame = 1000; % Number of QAM symbols per frame  berEstHard = zeros(size(EbNoVec));  trellis = poly2trellis(7,[171 133]);  tbl = 32;  rate = 1/2;  for n = 1:length(EbNoVec)  % Convert Eb/No to SNR  snrdB = EbNoVec(n) + 10\*log10(k\*rate);  % Noise variance calculation for unity average signal power.  noiseVar = 10.^(-snrdB/10);  % Reset the error and bit counters  [numErrsHard,numBits] = deal(0);  while numErrsHard < 100 && numBits < 1e7  % Generate binary data and convert to symbols  dataIn = randi([0 1],numSymPerFrame\*k,1);  % Convolutionally encode the data  dataEnc = convenc(dataIn,trellis);  % QAM modulate  txSig = qammod(dataEnc,M,'InputType','bit','UnitAveragePower',...  true);  % Pass through AWGN channel  rxSig = awgn(txSig,snrdB,'measured');  % Demodulate the noisy signal using harddecision (bit) and  % soft decision (approximate LLR) approaches.  rxDataHard = qamdemod(rxSig,M,'OutputType','bit','UnitAveragePower'...  ,true);  % Viterbi decode the demodulated data  dataHard = vitdec(rxDataHard,trellis,tbl,'cont','hard');  % Calculate the number of bit errors in the frame. Adjust for the  % decoding delay, which is equal to the traceback depth.  numErrsInFrameHard = biterr(dataIn(1:end- tbl),dataHard(tbl+1:end));  % Increment the error and bit counters  numErrsHard = numErrsHard + numErrsInFrameHard;  numBits = numBits + numSymPerFrame\*k;  end  % Estimate the BER for both methods  berEstHard(n) = numErrsHard/numBits;  end  %Plot the estimated hard and soft BER data. Plot the theoretical performance for an uncoded 64-QAM channel.  semilogy(EbNoVec, [berEstHard],'-\*')  hold on  semilogy(EbNoVec,berawgn(EbNoVec,'qam',M))  legend('Hard','Uncoded','location','best')  grid  xlabel('Eb/No (dB)')  ylabel('Bit Error Rate') |  |

Câu 6:

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| clear; clc  rng default  M = 4; % Modulation order  k = log2(M); % Bits per symbol  EbNoVec = (1:2:10); % Eb/No values (dB)  numSymPerFrame = 1000; % Number of QAM symbols per frame  berEstHard = zeros(size(EbNoVec));  trellis = poly2trellis(7,[171 133]);  tbl = 32;  rate = 1/2;  for n = 1:length(EbNoVec)  % Convert Eb/No to SNR  snrdB = EbNoVec(n) + 10\*log10(k\*rate);  % Noise variance calculation for unity average signal power.  noiseVar = 10.^(-snrdB/10);  % Reset the error and bit counters  [numErrsHard,numBits] = deal(0);  while numErrsHard < 100 && numBits < 1e7  % Generate binary data and convert to symbols  dataIn = randi([0 1],numSymPerFrame\*k,1);  % Convolutionally encode the data  dataEnc = convenc(dataIn,trellis);  % QAM modulate  txSig = qammod(dataEnc,M,'InputType','bit','UnitAveragePower',...  true);  % Pass through AWGN channel  rxSig = awgn(txSig,snrdB,'measured');  % Demodulate the noisy signal using harddecision (bit) and  % soft decision (approximate LLR) approaches.  rxDataHard = qamdemod(rxSig,M,'OutputType','bit','UnitAveragePower'...  ,true);  % Viterbi decode the demodulated data  dataHard = vitdec(rxDataHard,trellis,tbl,'cont','hard');  % Calculate the number of bit errors in the frame. Adjust for the  % decoding delay, which is equal to the traceback depth.  numErrsInFrameHard = biterr(dataIn(1:end- tbl),dataHard(tbl+1:end));  % Increment the error and bit counters  numErrsHard = numErrsHard + numErrsInFrameHard;  numBits = numBits + numSymPerFrame\*k;  end  % Estimate the BER for both methods  berEstHard(n) = numErrsHard/numBits;  end  %Plot the estimated hard and soft BER data. Plot the theoretical performance for an uncoded 64-QAM channel.  semilogy(EbNoVec, [berEstHard],'-\*')  hold on  semilogy(EbNoVec,berawgn(EbNoVec,'qam',M))  legend('Hard','Uncoded','location','best')  grid  xlabel('Eb/No (dB)')  ylabel('Bit Error Rate') |  |