

1. [20 points] Using the following program as a starting point, write programs to generate the following signals:

- (a) QPSK
- (b) OQPSK
- (c) MSK

*% Program which generates a BPSK waveform*

```
close all;
clear all;
```

```
numMessageBits = 5;
fc = 2;           % Carrier frequency
T = 1;           % Symbol duration
signalDuration = numMessageBits*T; % Signal duration
numSamplesPerSymbol = 100; % Number of samples per symbol
```

```
messageBits = floor(rand(1, numMessageBits) + 0.5);
bpskSymbols = 2*messageBits - 1;
```

```
samplingInstants = linspace(0, signalDuration, numMessageBits*numSamplesPerSymbol);
pamSignal = kron(bpskSymbols, ones(1, numSamplesPerSymbol));
% kron is the Kronecker product between matrices or vectors.
% Type "help kron" in the command window to understand how it works.
```

```
plot(samplingInstants, pamSignal.*cos(2*pi*fc*samplingInstants));
% The .* operator does element-wise multiplication between
% two vectors of same length
axis([0 signalDuration -1.5 1.5]);
```