Digital Communications Coursework

**1)** AMXUWSWQJWXAATATCRAGMQIOU

**2)** THISISNOTHINGTODOWITHPIRATESATALL

**3)** ASSOONASWESTARTEDPROGRAMMINGWEFOUNDTOOURSURPRISETHATITWASNTASEASYTOGETPROGRAMSRIGHTASWEHADTHOUGHTDEBUGGINGHADTOBEDISCOVEREDICANREMEMBERTHEEXACTINSTANTWHENIREALIZEDTHATALARGEPARTOFMYLIFEFROMTHENONWASGOINGTOBESPENTINFINDINGMISTAKESINMYOWNPROGRAMSMAURICEWILKESDISCOVERSDEBUGGING

**4i)** 17^2 = 11 mod 139

17^4 = 121 mod 139

17^8 = 46 mod 139

17^16 = 31 mod 139

17^32 = 127 mod 139

125

**4ii)** 2345^2 = 195245 mod 265189

2345^4 = 221653 mod 265189

2345^8 = 77513 mod 265189

2345^16 = 143185 mod 265189

2345^32 = 182635 mod 265189

2345^64 = 70805 mod 265189

2345^128 = 215169 mod 265189

2345^256 = 207374 mod 265189

2345^512 = 132069 mod 265189

2345^1024 = 209853 mod 265189

2345^2048 = 200702 mod 265189

2345^4096 = 144460 mod 265189

2345^8192 = 173623 mod 265189

2345^16384 = 116932 mod 265189

2345^32768 = 212973 mod 265189

32548

**4iii)** 4733459^2 = 49107677 mod 75968647

4733459^4 = 16238929 mod 75968647

4733459^8 = 67757406 mod 75968647

4733459^16 = 25488171 mod 75968647

4733459^32 = 64480977 mod 75968647

4733459^64 = 57889554 mod 75968647

4733459^128 = 19358089 mod 75968647

4733459^256 = 50744319 mod 75968647

4733459^512 = 56497489 mod 75968647

4733459^1024 = 54825938 mod 75968647

4733459^2048 = 38930457 mod 75968647

4733459^4096 = 49024383 mod 75968647

4733459^8192 = 51007254 mod 75968647

4733459^16384 = 24313 mod 75968647

4733459^32768 = 59341440 mod 75968647

64524344

**5i)** Cipher = Message^e mod n (in this case e=65537and n=76282747)

**5ii)** 39964485

**6i)** Message = Cipher^e mod n (in this case e=3497603 and n=9436709)

**6ii)** 1101011

**7i)** Firstly ‘decrypt' message with your own private Key (337722^ 3497603 mod 9436709), encrypt both message and signature separately ((message and the signature) ^ 65537mod 76282747) and then send both to the receiver.

**7ii)** M=33191197

S=59821766

**8i)** Decrypt both the message and the signature separately ((message and the signature) ^ 3497603 mod 9436709) and then encrypt the signature with your private key ((Decrypted signature) ^ 65537mod 76282747). If the message and the ‘encrypted’ signature match, then the message is from the right person.

**8ii)**

Decrypted Message=7406060

Decrypted Signature=8180219

Decrypted Signature ‘encrypted’ with banks public key = 64026314

**8iii)** Decrypted Message and the Decrypted Signature encrypted with the banks public key are not equal and therefore it is not a valid message.

**9)** If you choose a random number < n and create message m =R^(public key of who you are pretending to be) mod n (i.e. R^53407 mod 122269479 send (M,S=R) encrypted with the recipients public key and modulus. They will decrypt it normally and the message with fit with the signature. Assuming the bank correctly decrypts the message for R=100 they will have an M=97612969 and S=100 which when decrypted (100^ 53407 mod 122269479).

**10)** Because the pin is only three digits long it is possible to just use brute force. Bob’s new pin is 777. This is because I wrote a program that encrypted all the possible combinations for a three-digit pin and then if they appeared in the message they were outputted. The only output was 777.