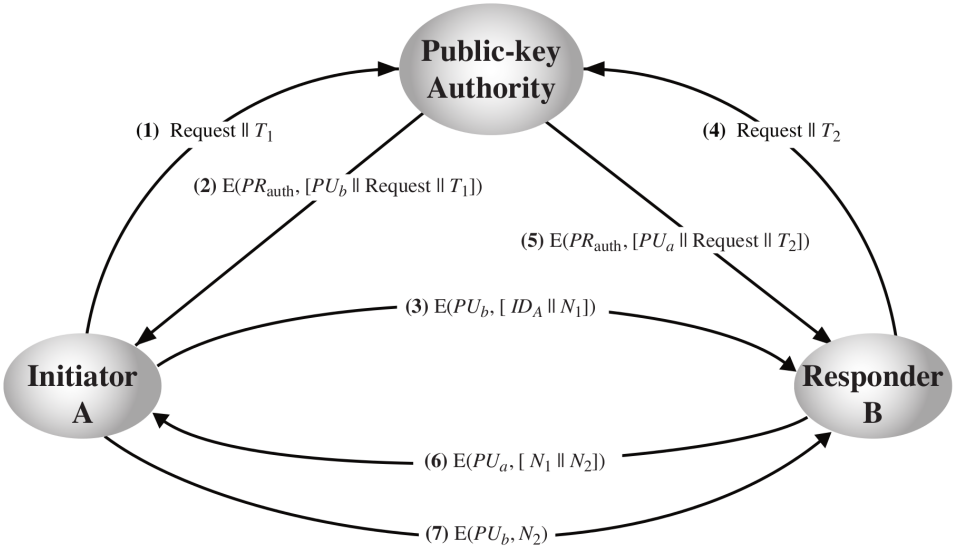
CSS322 – Quiz 11

Name: _____ ID: _____ Marks: ____ (10)

Question 1 [2 marks]

Consider the scheme in the figure below.



(a) List all keys assumed to be known by the authority before the scheme starts (i.e. before message (1) is sent). [1 mark]

(b) List all keys known by A after the scheme is finished (i.e. after message (7) is sent). [1 mark]

Question 2 [5 marks]

Consider the X.509 certificate in Listing 1.

Listing 1: X.509 Certificate

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 3 (0x3)
        Signature Algorithm: sha1WithRSAEncryption
        Issuer: C=TH, ST=Pathumthani, O=Malicous, OU=Department,
                CN=Malicious Department
        Validity
            Not Before: Jan 25 02:25:10 2011 GMT
```

```
            Not After : Jan 25 02:25:10 2012 GMT
        Subject: C=TH, ST=Pathumthani, O=DigiCert, OU=Secure,
                 CN=DigiCertSecure
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (1024 bit)
                Modulus (1024 bit):
                    00:aa:1f:cf:01:2f:d3:2e:80:63:98:1b:0f:16:5d:
                    dd:af:e2:38:de:78:88:56:b6:14:2b:61:79:92:0b:
                    f3:7f:b6:89:7b:d0:fc:59:5a:1a:be:24:61:39:d5:
                    4d:80:3a:40:2b:7c:89:ef:5e:50:a5:3b:44:68:a9:
                    7f:97:d9:c4:9a:bf:b6:97:eb:4c:87:0d:00:96:b4:
                    f9:ea:8c:6a:cb:e0:bd:f8:a8:1f:82:d3:2b:23:3c:
                    b6:54:85:37:5b:13:1a:2e:be:0d:20:52:c5:98:b6:
                    4c:97:67:6e:b2:43:04:3f:01:41:8e:e0:2f:38:1f:
                    e1:cc:cf:0d:c2:5f:0a:04:ae
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            X509v3 Basic Constraints:
                CA:FALSE
            Netscape Comment:
                OpenSSL Generated Certificate
            X509v3 Subject Key Identifier:
                EA:1C:DC:C5:16:F2:9D:BC:61:5E:A8:D2:67:2A:06:13:C5:64:8A:49
            X509v3 Authority Key Identifier:
                keyid:61:52:40:EA:7F:E0:EC:77:41:F6:4F:6F:7C:49:EB:05:C1:56:6D:AE

    Signature Algorithm: sha1WithRSAEncryption
        a5:7a:36:91:ef:11:46:58:74:37:87:81:7a:99:ff:b6:40:4a:
        80:6a:07:69:e3:3c:33:9a:fd:31:50:e9:9f:bf:ff:36:a4:34:
        21:50:49:70:e0:88:b3:01:c9:51:26:8b:1e:8b:34:ca:4c:3c:
        a2:ab:0a:a3:b3:39:c0:fb:88:72:98:69:c9:af:42:b2:48:1b:
        4e:4a:76:e8:b4:c7:d4:f8:15:d2:5e:f8:69:fc:53:0c:ca:85:
        84:ea:e5:36:17:20:65:fc:d0:3e:d1:33:17:f7:d1:40:f8:3d:
        2a:87:f8:3c:66:8e:43:62:ea:02:ef:7a:d4:a7:55:e9:d9:2d:
        38:1a
-----BEGIN CERTIFICATE-----
MIIC5zCCAlCgAwIBAgIBAzANBgkqhkiG9w0BAQUFADCBnzELMAkGA1UEBhMCVEgx
GDASBgNVBAgTC1BhdGh1bXRoYW5pMREwDwYDVQQHEwhCYW5na2FkaTENMAsGA1UE
ChMEU0lJVDEMMAoGA1UECxMDSUNUMR4wHAYDVQQDExVDZXJ0aWZpY2F0ZSBBdXRo
b3JpdHkxKjAoBgkqhkiG9w0BCQEWG2NzczMyMi1jYUBpY3Quc2lpdC50dS5hYy50
aDAeFw0xMTAxMjUwMjI1MTBaFw0xMjAxMjUwMjI1MTBaMFYxCzAJBgNVBAYTAlRI
MRQwEgYDVQQIEwtQYXRodW10aGFuaTENMAsGA1UEChMEU0lJVDEMMAoGA1UECxMD
SUNUMRQwEgYDVQQDEwtEZW1vIFVzZXIgMjCBnzANBgkqhkiG9w0BAQEFAAOBjQAw
gYkCgYEAqh/PAS/TLoBjmBsPFl3dr+I43niIVrYUK2F5kgvzf7aJe9D8WVoaviRh
OdVNgDpAK3yJ715QpTtEaKl/l9nEmr+2l+tMhw0AlrT56oxqy+C9+KgfgtMrIzy2
VIU3WxMaLr4NIFLFmLZMl2duskMEPwFBjuAvOB/hzM8Nwl8KBKMCAwEAAaN7MHkw
CQYDVR0TBAIwADAsBglghkgBhvhCAQ0EHxYdT3BlblNTTCBHZW5lcmF0ZWQgQ2Vy
dGlmaWNhdGUwHQYDVR0OBBYEFOoc3MUW8p28YV6oOmcqBhPFZIquMB8GA1UdIwQY
MBaAFGFSQOp/4Ox3QfZPb3xJ6wXBVm1JMA0GCSqGSIb3DQEBBQUAA4GBAKV6NpHv
EUZYdDeHgXqZ/7ZASoBqB2njPDOa/TFQ6Z+//zakNCFQSXDgiLMByVEmix6LNMpM
PKKrCqOzOcD7iHKYacmvQrJIGO5Kdui0x9T4FdJe+Gn8UwzKhYTq5TYXIGX80D7R
Mxf30UD4PSqH+DxmjkNi6gLvetSnVenZLTa3
-----END CERTIFICATE-----
```

(a) Whose certificate is this? [1 mark]

(b) Whose RSA key is included in the certificate? [1 mark]

(c) The RSA algorithm is: $C = M^e \bmod n$. What are the last two hexadecimal digits

of n in the users RSA key? [1 mark]

In general, an X.509 certificate for user A can be expressed as:

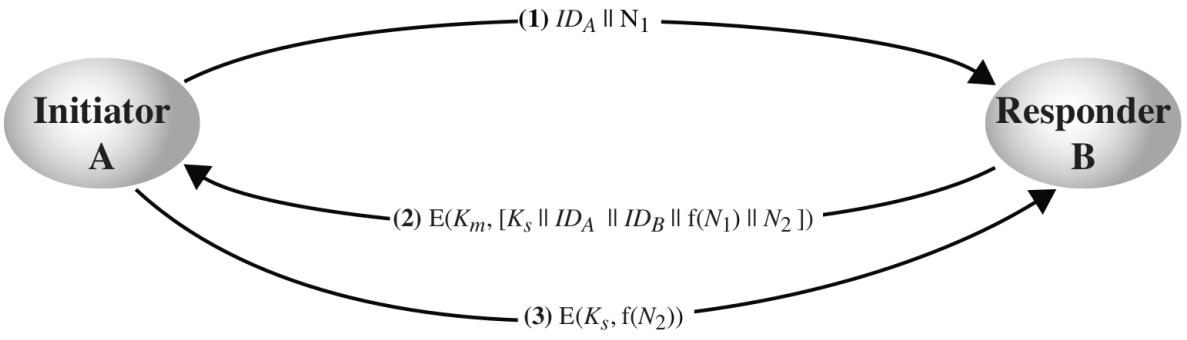
$$C_A = Data||S$$

where *Data* is the concatenation of the fields: Version, SerialNumber, SignatureAlgorithm, Issuer, Validity, Subject, SubjectPublicKeyInfo and X509v3extensions.

(d) Write an equation for how S is calculated in the certificate in Listing 1? You must use the names of algorithms used in the above certificate (i.e. you cannot use E()), as well as clearly identify which user each key belongs to. You may use the variable *Data* in your equation to represent the concatenation of various fields. [2 marks]

Question 3 [3 marks]

Considered the scheme below (top of next page).



(a) For this scheme to work, what keys are known by A and B before the 3 steps are taken? [1 mark]

(b) Assume a network has 20 users, all using the above scheme. How many keys in total must be manually distributed prior the scheme being used? [2 marks]