CS110a Winter 2005 Midterm

Name:

Perm No:

Open book and notes, no computers. Raise your hand if you have any doubt.

1. [20 points, 5 per part] Let `x`, `p`, and `A` be defined by the Matlab statements:

```
x = [31 41 59];
p = [3 1 2];
A = [1 2 3 ; 4 5 6 ; 7 8 9];
```

What is the value of `y` after each of the following?

(a)
```
y = x(p)
```

(b)
```
y(p) = x
```

(c)
```
y = A([3 1], :)
```

(d)
```
y = A(p,p)
```

2. [20 points, 10 per part] What is the output? Show at least the first 3 lines and last 3 lines. Partial credit for answers that have the right idea but not quite the right numbers.

(a)
```
x = 1;
while x+x > x;
     x = 10*x
end;
```

(b)
```
x = 1;
while 1+x > x;
    x = 10*x
end;
```

3. [20 points, 10 per part]

(a) Suppose `A` is an `n by n` symmetric, positive definite matrix and `b` is a column vector of dimension `n`. Recall that the Cholesky factor `R` of `A` is the upper triangular matrix such that `R' * R = A`. Fill in the blanks below to compute the solution `x` to `A * x = b`. You may use `R` but not `A`.

```
R = chol(A);

y = __________  \  __________ ;

x = __________  \  __________ ;
```

(b) Now suppose in addition that `p` is a permutation vector, that is, a vector whose elements are the integers `1` through `n` in some order. Fill in the blanks to compute the solution `x` to `A * x = b`. Again you may not use `A`.

```
R = chol(A(p,p));

__________ = __________  \  __________ ;

__________ = __________  \  __________ ;
```

4. [21 points, 3 per part] Suppose that:

```
A = [1 1 1 ; 1 2 3 ; 1 3 6];
x = A \ [6 ; 14 ; 25];
y = A * [4 ; -1 ; 0];
[L,U,p] = lutx(A);
R = chol(A);
C = inv(A);
```

Choose an answer 1-7 to match each letter:

(a) x ___

(b) y ___

(c) L ___

(d) U ___

(e) p ___

(f) R ___

(g) C ___

(1)
```
 1   0   0
 1   1   0
 1  .5   1
```

(2)
```
 3  -3   1
-3   5  -2
 1  -2   1
```

(3)
```
 1   1   1
 0   2   5
 0   0   -.5
```

(4)
```
 1   1   1
 0   1   2
 0   0   1
```

(5)
```
 3
 2
 1
```

(6)
```
 1
 2
 3
```

(7)
```
 1
 3
 2
```

5. [19 points] Find a 3 by 3 matrix `A` and a `3`-vector `b` such that

```
x = bslashtx(A,b)
```

will produce the message

```
Warning: Divide by zero
```