

MATH 20 – PROBLEM SET 7 (DUE AUGUST 22)

This problem set is due at the *beginning* of class. This is just the problem list; please work out these problems on a different sheet of paper. Please write neatly, staple the pages together, and explain your work where appropriate. **When needed, use R or some other software to do your calculations. Submit your answers (and justifications) but not your code.** You may find the following matrix commands useful.

Matrix Commands in R:

To create a matrix, create a single list of all entries, filling in the first column, then the second, etc. Then specify the number of rows and columns using the `nrow` and `ncol` commands. Put this all together using the `matrix` function, as in the examples below.

```
> A <- matrix(c(2, 4, 6, 8, 10, 12, 14, 16), nrow = 4, ncol=2)
> A
      [,1] [,2]
[1,]    2   10
[2,]    4   12
[3,]    6   14
[4,]    8   16
```

```
> B <- matrix(c(6, 5, 4, 3, 2, 1), nrow = 2, ncol = 3)
> B
      [,1] [,2] [,3]
[1,]    6    4    2
[2,]    5    3    1
```

We can add matrices componentwise the same way we would for numbers.

```
> C <- A+B
> C
      [,1] [,2]
[1,]    4   20
[2,]    8   24
[3,]   12   28
[4,]   16   32
> C+A
      [,1] [,2]
[1,]    6   30
[2,]   12   36
[3,]   18   42
[4,]   24   48
```

We cannot simply use `*` to multiply matrices, as it would try to perform this operation componentwise. Instead, use `%*%`:

```
> D <- A %*% B
> D
      [,1] [,2] [,3]
[1,]    62    38    14
[2,]    84    52    20
[3,]   106    66    26
[4,]   128    80    32
```

To create the diagonal n -by- n matrix, use `diag(n)`.

```
> I <- diag(3)
> I
      [,1] [,2] [,3]
[1,]     1     0     0
[2,]     0     1     0
[3,]     0     0     1
```

Finally, invert a square (invertible) matrix P using the function `solve(P)`:

```
> P <- matrix(c(0.9, 0.2, 0.1, 0.2), nrow=2, ncol=2)
> P
      [,1] [,2]
[1,]   0.9   0.1
[2,]   0.2   0.2
> solve(P)
      [,1] [,2]
[1,]  1.25 -0.625
[2,] -1.25  5.625
> solve(diag(2) - P)
      [,1] [,2]
[1,] 13.33333 1.666667
[2,]  3.33333 1.666667
```

Problem List

1. GS p. 413 #2
2. GS p. 413 #8
3. GS p. 422 #12 (\mathbf{Nc} is the (column) vector of row sums of \mathbf{N})
4. GS p. 422 #18
5. GS p. 442 #2 (don't use a computer for c), and show your work)