**Example Midterm Question:** Match up the following *Mathematica* inputs to outputs (note that the inputs may or may not contain errors):

| INPUT: | OUTPUT: |
|---|---|
| `Integrate[Sin(x), x]` | $\int \sin[x]\, dx$ |
| `D[Sin[x], x]` | `-Cos[x]` |
| `Integrate[sin[x], x]` | $\frac{\text{Sin x}^2}{2}$ |
| `D[Sin(x), x]` | `Cos[x]` |
| `Integrate[Sin[x], x]` | `Sin` |

**Example Midterm Question:** Match up the following *Mathematica* inputs to outputs (note that the inputs may or may not contain errors):

| INPUT: | OUTPUT: |
|---|---|
| `Integrate[2 - 3 x + x^2, x]` | `Solve::eqf: 2 - 3 x + x^2 is not a well-formed equation` |
| `Solve[2 - 3 x + x^2, x]` | $2-3x+x^2$ |
| `Integrate[2 - 3 x + x^2, {x,0,1}]` | $2x-\frac{3x^2}{2}+\frac{x^3}{3}$ |
| `Solve[2 - 3 x + x^2== 0, x]` | $\frac{5}{6}$ |
| `D[2 - 3 x + x^2]` | $\{\{x\to 1\},\{x\to 2\}\}$ |

**Example Final Question:** Figure out what the following *Mathematica* simulation does by reading the code and deducing what sort of process is being modeled.

```
<<Statistics`ContinuousDistributions`
```

```
?UniformDistribution
```

UniformDistribution[min, max] represents the uniform distribution on the interval {min, max}

```
Clear[num]
num[t_,a_,b_,n0_] := num[t,a,b,n0] = num[t-1,a,b,n0]*Random[UniformDistribution[a,b]]
num[0,a_,b_,n0_] := n0
```

(a) This model is (circle one each):

Discrete time    or    continuous time

Deterministic    or    stochastic

(b) This model is a variant of which model studied in class (circle one):

Exponential growth    or    Logistic growth    or    Haploid selection    or    Spread of disease

(c) Describe a research question that you could address using this simulation program?

**Example Final Question:** A fellow student has written *Mathematica* code to run a simulation, but is getting very frustrated because *Mathematica* fails to produce a plot. The following codes include three incorrect versions and one correct version. In each case, state whether or not the code would work and, for the codes that do not work, point out the error:

(a)

```
x[t_, a_, b_] := x[t, a, b] = x[t-1, a, b]  + a x[t-1, a, b] /(1+ x[t-1, a, b]  b)

x[0, a_, b_] =1.0

ListPlot[Table[ x[t, a, b] , {t, 0, 200}]]
```

(b)

```
x[t_, a_, b_] := x[t, a, b] = x[t-1, a, b]  + a x[t-1, a, b] /(1+ x[t-1, a, b]  b)

x[0, a_, b_] =1.0

ListPlot[Table[ x[t, 0.1, 100] , {t, 0, 200}]]
```

(c)

```
x[t_, a_, b_] := x[t, a, b] = x[t, a, b]  + a x[t, a, b] /(1+ x[t, a, b]  b)

x[0, a_, b_] =1.0

ListPlot[Table[ x[t, 0.1, 100] , {t, 0, 200}]]
```

(d)

```
x[t_, a_, b_] := x[t, a, b] == x[t-1, a, b]  + a x[t-1, a, b] /(1+ x[t-1, a, b]  b)

x[0, a_, b_] == 1.0

ListPlot[Table[ x[t, 0.1, 100] , {t, 0, 200}]]
```