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Simulation

Mr. Edem K. Bankas

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- Solve the following set of simultaneous equations by Gauss-Jordan method

$$4x_1 + 2x_2 - 3x_3 = 2$$

$$3x_1 + x_2 - 2x_3 = 1$$

$$2x_1 - 2x_2 + x_3 = 2$$

$$(x_1, x_2, x_3)' = (2, 3, 4)'$$

Simulation

- Simulation is an area of application where computer programs are designed to mimic real life situations.
- Simulation programs are important because, sometimes we can not predict before hand what the outcome of an experiment will be. E.g., rolling a die, spinning a coin, bacteria division, etc

Simulation

- In most cases, one of the following situations may arise:
 - It is not possible to observe the behaviour directly or to conduct the experiment by hand
 - Chances play a part in the outcomes

Simulation

- Any algorithm of simulating the behaviour of a real system requires a random number generator

Random Numbers

- In MATLAB, the command `rand(1)` displays a random number between 0 and 1
 - E.g., `>> y = rand(1)`
 - E.g., `rand(1,n)`
 - E.g., `rand`
- Other random numbers can be created using the `rand` function

Random Numbers

- Random events are easily simulated in MATLAB with the **rand** function

Bacteria Division

- Simulate a bacterium growth by assuming that a certain type of bacterium divides or dies according to the following:
 - During a fixed time interval called a generation, a single bacterium divides into two identical replica with probability $p = 0.75$
 - If bacterium does not divide during an interval, the bacterium dies

Solution

```
r = rand;  
if r < 0.75  
    disp('I now have an offspring')  
else  
    disp('I am dead')  
end
```

Rolling Dice

- When a fair die is rolled, the number uppermost is equally likely to be any integer from 1 to 6.
- In this case we use the MATLAB statement
$$d = \text{floor}(6 * \text{rand} + 1)$$

Example

- A fair die is rolled 80 times. Write MATLAB codes to simulate this experiment and compute the mean, standard deviation and the probability of obtaining a (5).

Solution

```
% rolling a die 80 times
s=0; % count the number of five appearing
v = [1 : 80 ]; % a vector to hold the outcome
for i = 1 : 80
    d = floor (6 * rand +1);
    v(i) = d;
    if d == 5
        s = s + 1;
    end;
end;
disp(v);
disp('number of 5'); disp(s)
disp('Mean: '); disp( mean(v));
disp('standard deviation: '); disp( std(v));
disp('probability of getting a 5: '); disp( s/80 );
```

END OF TRIM

- Please prepare very well
- Read the instructions very well and abide by the rules
- Remember that if your misconduct calls for cancellation of your paper, I will have nothing to do than to comply
- Try as much as possible to use the allocated time

