Latex Template

Hunter Kruger-Ilingworth (14198489)

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1 Code

1.1 Python

Listing 1: Python code to create an incidence matrix

```python
import numpy as np
def incmatrix(genl1,genl2):
    m = len(genl1)
    n = len(genl2)
    M = None #to become the incidence matrix
    VT = np.zeros((n*m,1), int)  #dummy variable
    x = 0
    #compute the bitwise xor matrix
    M1 = bitxormatrix(genl1)
    M2 = np.triu(bitxormatrix(genl2),1)

    for i in range(m-1):
        for j in range(i+1, m):
            [r,c] = np.where(M2 == M1[i,j])
            for k in range(len(r)):
                VT[(i)*n + r[k]] = 1;
                VT[(i)*n + c[k]] = 1;
                VT[(j)*n + r[k]] = 1;
                VT[(j)*n + c[k]] = 1;

                if M is None:
                    M = np.copy(VT)
                else:
                    M = np.concatenate((M, VT), 1)

                VT = np.zeros((n*m,1), int)

    return M
```

1.2 Matlab

Listing 2: MATLAB Code that tests Solar System Function

```
function test_advanced_level(unit_under_test)
    % TEST_ADVANCED_LEVEL Test the simulator against the advanced level of achievement.
    %
    % TEST_ADVANCED_LEVEL(@unit) tests a function called "unit" instead of the
    % default, "solarsystem".
    %
    % This is provided as a means for your to test your program's accuracy. We
    % supply here high precision answers that can use as a benchmark against
    % which to compare your code.
    %
    % A program similar to this one will be used during marking to test your
    % program's accuracy and speed. We'll use different initial conditions, so
    % don't try simply hard-coding these answers! :)
    %

    % Default to a function named "solarsystem"
    if nargin < 1
        unit_under_test = @solarsystem;
    end

    % Data
    % Data source: NASA JPL Development Emphemeris DE405, imported into Matlab
    % using https://au.mathworks.com/matlabcentral/fileexchange/46074-jpl-ephemeris-manager
    mass = [1.98879724324801e+30;3.30167548185139e+23;4.86825414184162e+24;5.97333182929537e+24;6.41814989746695e+23;1.89888757501372e+27;5.68569250232054e+26;8.68357411676561e+25;1.02450682828011e+26;1.47100387814202e+22];
    p = [-410978934.937975 -52564098.573049 -11647539.5911275;-20263704896.5463 37298969437.5484 21998926177.1807;107457059203.846 12751258164.7855 -1081247256.91775;-104473131433.549 95807463843.1787 41554965796.5625;-47532402438.2755 -197479402904.819 -89286739068.5338;740812325977.265 -29623952257.2314 -30753799138.017;-391719672964.493 1189107854643.27 507856891148.711;-2396814857836.84 -1270773906334.37 -522608874439.045;-1545201887440.28 -3957617757444.78 -1581427940931.15;-4371341308972.33 -1084064015240.84 978703610774.062];
    v = [1.94673233456669 -10.8814016462929 -4.7775329435922;-54017.2779417951 -18415.0969798133 -4228.50548119061;-3793.57777814318 31524.0648690534 14419.9306824639;-21597.9402281813 -19392.9951239518 -8410.50277824797;24596.1594690375 -2563.11636886769 -1841.7251251432;538.777252737696 12558.0983493514 5370.16231719295;-9767.15104601119 -2764.87492216388 -721.832483731844;3335.76872430951 -5686.29309895411 -2537.72389267233;5074.99185394443 -1640.69964089467 -797.853610190395;1586.81468930053 -5301.34210829372 -2132.29213550457];

    % Use inner planets only; supply them in the order Sun, Earth, Mercury,
    % Venus, Mars (so that colours used for the Sun and Earth in the other
```

```
    % tests apply here too)
    i = [1 4 2 3 5];
    mass = mass(i);
    p = p(i,:);
    v = v(i,:);

    % Test 1
    Test_3D_Solar_System(false);

    % Test 2
    Test_3D_Solar_System(true);

        function test_result(parameter, value, units, comparator, benchmark)
            if strcmp(units, '%')
                fprintf('  %28s :  %-15.6f', [parameter ' (' units ')'], value);
            else
                fprintf('  %28s :  %-15.6g', [parameter ' (' units ')'], value);
            end

            if nargin == 5
                if comparator(value, benchmark)
                    fprintf('   ** PASS. Meets or exceeds the expectation of %g%s', benchmark, units);
                else
                    fprintf('   ** FAIL. Does not meet the expectation of %g%s', benchmark, units);
                end
            end
            fprintf('\n');
        end


        function Test_3D_Solar_System(speed_test)
            if speed_test
                fprintf('<strong>*** [Advanced level] Inner planets in 3D (execution speed test)</strong>\n');
            else
                fprintf('<strong>*** [Advanced level] Inner planets in 3D</strong>\n');
            end

            % Run the program
            tic();
            [final_p, final_v] = unit_under_test(p, v, mass, 400*24*60*60, speed_test);
            t = toc();
            test_result('Execution time', t, 's');

            % Check the dimensions of the return values
            assert(all(size(final_p) == size(p)), 'Expected size of return value "p" to be %ix%i, received %ix%i instead.', size(p,1), size(p,2), size(final_p, 1), size(final_p, 2));
```

```
        assert(all(size(final_v) == size(v)), 'Expected size of return value "v" to be %ix%i, received %ix%i instead.', size(v,1), size(v,2), size(final_p, 1), size(final_p, 2));

        % Check the answers
        correct_p = [-345966512.946938 -427734515.389726 -176305011.39972;-146624134718.92 23657267681.4718 10263838966.7501;18103318019.8 -57037628697.2036 -32327489902.5598;32774480992.525 -94215943100.9452 -44459425421.2662;-136512481872.172 183605819453.111 87921613716.9978];
        correct_v = [1.80779317569275 -10.8097599943337 -4.73922210995349;-5754.8524496641 -27006.432527836 -11711.495344779;37086.6176187111 15367.1705312566 4360.22910247245;33125.9176644671 10361.9441289187 2564.05625302394;-19228.3713286498 -10562.8647670158 -4323.54314113474];

        % mercury is harder to simulate because it moves the fastest
        % the objects are in this order: Sun, Earth, Mercury, Venus, Mars
        expectations = [0.1 1 5 1 1];
        for i = 1:size(p,1)
            test_result(sprintf('Object %i position error', i), norm(final_p(i,:) - correct_p(i,:))/norm(correct_p(i,:))*100, '%', @le, expectations(i));
            test_result(sprintf('Object %i velocity error', i), norm(final_v(i,:) - correct_v(i,:))/norm(correct_v(i,:))*100, '%', @le, expectations(i));
        end
    end

end
```

It can clearly be seen from listings 1 to 2 that code chunks are cool and sick.

2 Figure Rendering

2.1 3D Plots

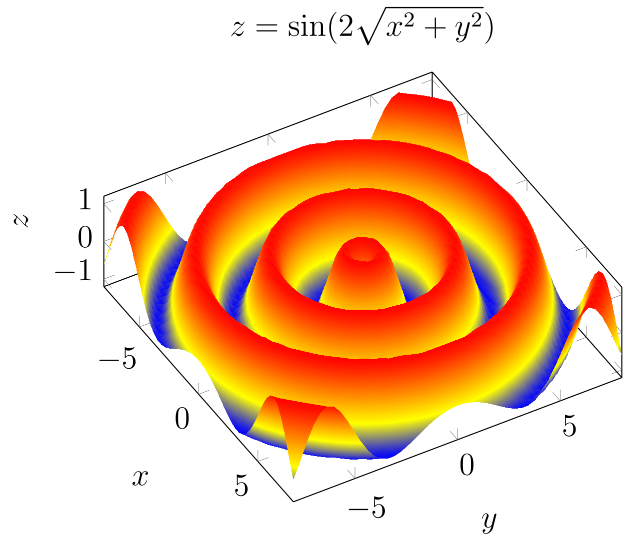


Fig. 1. 3D plot of $z = \sin(2\sqrt{x^2 + y^2})$

3 Table input from csv

Country	Population	Area	Oil Prod.	GDP	Education	Roadways	Net Users
Australia	23232413	7741220	289700	50300	5.6	0.106342024	60%
Canada	35623680	9984670	3679000	48300	5.4	0.10439003	60%
France	67106161	643801	16420	43800	5.9	1.597459463	60%
Germany	80594017	357022	46590	50400	5.1	1.806611357	60%
Italy	62137802	301340	70670	38100	4.5	1.618437645	60%
Japan	126451398	377915	3918	42800	3.8	3.224989746	60%
Russia	142257519	17098242	10550000	27800	4.1	0.075059588	60%
United Kingdom	65648100	243610	933000	44100	6.2	1.619096096	60%
United States	326625791	9833517	8853000	59500	5.4	0.669812235	60%

Table 1: Your Table Caption

4 Tcolorboxes

4.1 General application

My nice heading

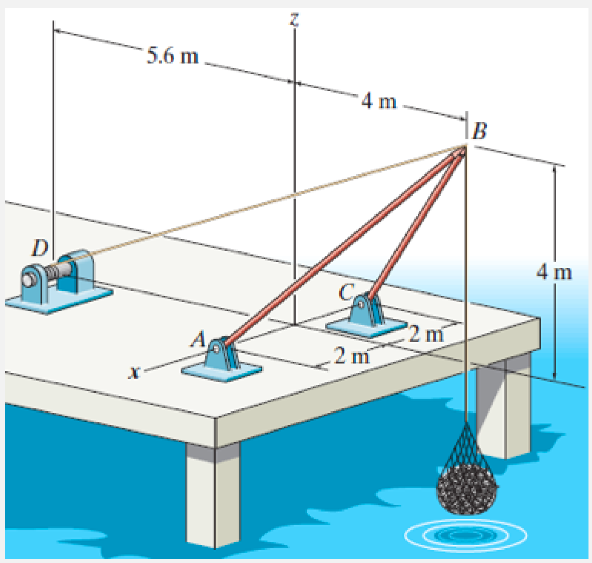
This is a tcolorbox with a heading

Upper part of my box.

Lower part of my box.

4.2 With image

Statics Problem Example



The shear leg derrick is used to haul the 200-kg net of fish onto the dock. Determine the compressive force along each of the legs AB and CB and the tension in the winch cable DB. Assume the force in each leg acts along its axis.