```matlab
 1 % NAME: ADITYA BARMAN
 2 % ROLL: 002320601024
 3 % PROBLEM 6. Co-variance with Frequency
 4
 5
 6 clc, clearvars, close all
 7
 8 n = 100;
 9 f_vals = [0 0 0 2 4 4
10 0 0 1 4 6 5
11 0 0 5 10 8 1
12 1 4 9 5 2 0
13 3 6 6 2 0 0
14 3 5 4 0 0 0];
15
16 % initializing upper and lower bounds for x & y
17 up_bd_x = [49 59 69 79 89 99];
18 up_bd_y = [99 89 79 69 59 49];
19 lw_bd_x = [40 50 60 70 80 90];
20 lw_bd_y = [90 80 70 60 50 40];
21
22 % initialiazing midpts and assumed means (same for x & y)
23 midpts_x = (up_bd_x + lw_bd_x) / 2;
24 midpts_y = (up_bd_y + lw_bd_y) / 2;
25 mean_asmd_xy = 74.5;
26 % obtaining factor from subtraction from assumed mean
27 diff_factor = 10;
28
29 % calculating u & v vals
30 u_vals = zeros(1, 6);
31
32 for i = 1:6
33     u_vals(i) = ((midpts_x(i) - mean_asmd_xy) / diff_factor);
34 end
35
36 v_vals = u_vals(end:-1:1);
37
38 % initializing a 6x6 zero matrix to store fuv values
39 fuv = zeros(6, 6);
40 % following loop traverses through each cell and stores the required↵
value
```

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41 for j = 1:6
42     for k = 1:6
43         fuv(j, k) = f_vals(j, k) * v_vals(j) * u_vals(k);
44     end
45 end
46
47
48 % initializing required matrices
49 % for v
50 f_v = [10 16 24 21 17 12]; % given
51 fv = zeros(1, 6);
52 fv_sq = zeros(1, 6);
53 f_uv = 0;
54
55 %for u
56 f_u = [7 15 25 23 20 10]; % given
57 fu = zeros(1, 6);
58 fu_sq = zeros(1, 6);
59
60 % calculating fu, fv, fu^2, fv^2
61 for a = 1:6
62     fv(a) = f_v(a) .* v_vals(a);
63     fv_sq(a) = f_v(a) .* (v_vals(a)^2);
64     fu(a) = f_u(a) .* u_vals(a);
65     fu_sq(a) = f_u(a) .* (u_vals(a)^2);
66 end
67
68 % calculating f_uv
69 for m = 1:36
70     f_uv = f_uv + fuv(m);
71 end
72 % calculating respective sums
73 fv_sum = 0;
74 fv_sq_sum = 0;
75 fu_sum = 0;
76 fu_sq_sum = 0;
77
78 for d = 1:6
79     fv_sum =fv_sum + fv(d);
80     fv_sq_sum =fv_sq_sum + fv_sq(d);
81     fu_sum =fu_sum + fu(d);
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```matlab
82       fu_sq_sum =fu_sq_sum + fu_sq(d);
83 end
84
85 % calculating square of summation of fu & fv respectively
86 fu_sum_sq = fu_sum ^ 2;
87 fv_sum_sq = fv_sum ^ 2;
88
89 % calculating co-variance between x & y
90 corr_coeff_num = (n*f_uv) - (fu_sum*fv_sum);
91 covar_xy = corr_coeff_num/100;
92 % corr_coeff_denom = (sqrt((n*fu_sq_sum)-fu_sum_sq))*(sqrt↵
((n*fv_sq_sum)-fv_sum_sq));
93 % corr_coeff = corr_coeff_num / corr_coeff_denom;
94
95 fprintf('Co-variance between the marks in Mathematics and the marks↵
in Physics is: %.4f\n', covar_xy);
96
97 % ===================== OUTPUT =============================
98
99 % Co-variance between the marks in Mathematics and the marks in↵
Physics is: 160.2000
100
101 % =========================================================
```