Array Draw Random Index and Find Combinations or Permuations

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Matlab Draw Random with and without Replacement

```
%Generate a matrix named foo, with limited numbers
rng(1234);
foo = unique((round((randn(5,1)+1)*100)));
disp(foo);

5
78
154
219
232
```

```
% draw 10 random samples without replacement
index = randsample(1:length(foo), 4);
bar_rand_noreplace = foo(index,:);

% draw 1000 random samples with replacement
index = randsample(1:length(foo), 4, true);
bar_rand_replace = foo(index,:);

% Display
disp(table(bar_rand_noreplace, bar_rand_replace));
```

bar_rand_noreplace	bar_rand_replace			
5	78			
78	154			
154	219			
232	219			

Matrix Meshgrid to Loop Permutated Vectors

Meshgrid to generate all permutations of arrays.

```
k = linspace(1,10,10);
kp = linspace(1,10,10);
z = linspace(0,1,10);

[kM kpM zM] = meshgrid(k,kp,z);
kMVec = kM(:);
kMpVec = kpM(:);
zMVec = zM(:);

outputVec = zeros(size(zMVec));
for a=1:length(zMVec)
    outputVec(a) = kMVec(a)+kMpVec(a);
end
```

outputTens = reshape(outputVec,size(kM)); disp(outputTens);

(:,:,1) =									
3 4 5 6 7	1 12	5 6 6 7 7 8 8 9 9 10 10 11 11 12 12 13 13 14 14 15	7 8 9 16 10 11 12 13 14 15 16 17	10 11 12 13 13 14 15 16 16	10 11 11 12 12 13 13 14 14 15 15 16 16 17 17 18 18 19 19 20				
(:,:,2) =									
2.1111 3.1111 4.1111 5.1111 6.1111 7.1111 8.1111 9.1111 10.1111 11.1111	3.1111 4.1111 5.1111 6.1111 7.1111 8.1111 9.1111 10.1111 11.1111 12.1111	4.1111 5.1111 6.1111 7.1111 8.1111 9.1111 10.1111 11.1111 12.1111 13.1111	5.1111 6.1111 7.1111 8.1111 9.1111 10.1111 11.1111 12.1111 13.1111 14.1111	6.1111 7.1111 8.1111 9.1111 10.1111 11.1111 12.1111 13.1111 14.1111 15.1111	7.1111 8.1111 9.1111 10.1111 11.1111 12.1111 13.1111 14.1111 15.1111 16.1111	8.1111 9.1111 10.1111 11.1111 12.1111 13.1111 14.1111 15.1111 16.1111 17.1111	9.1111 10.1111 11.1111 12.1111 13.1111 14.1111 15.1111 16.1111 17.1111 18.1111	10.1111 11.1111 12.1111 13.1111 14.1111 15.1111 16.1111 17.1111 18.1111 19.1111	11.1111 12.1111 13.1111 14.1111 15.1111 16.1111 17.1111 18.1111 19.1111 20.1111
(:,:,3) =									
2.2222 3.2222 4.2222 5.2222 6.2222 7.2222 8.2222 9.2222 10.2222 11.2222	3.2222 4.2222 5.2222 6.2222 7.2222 8.2222 9.2222 10.2222 11.2222 12.2222	4.2222 5.2222 6.2222 7.2222 8.2222 9.2222 10.2222 11.2222 12.2222 13.2222	5.2222 6.2222 7.2222 8.2222 9.2222 10.2222 11.2222 12.2222 13.2222 14.2222	6.2222 7.2222 8.2222 9.2222 10.2222 11.2222 12.2222 13.2222 14.2222 15.2222	7.2222 8.2222 9.2222 10.2222 11.2222 12.2222 13.2222 14.2222 15.2222 16.2222	8.2222 9.2222 10.2222 11.2222 12.2222 13.2222 14.2222 15.2222 16.2222 17.2222	9.2222 10.2222 11.2222 12.2222 13.2222 14.2222 15.2222 16.2222 17.2222 18.2222	10.2222 11.2222 12.2222 13.2222 14.2222 15.2222 16.2222 17.2222 18.2222 19.2222	11.2222 12.2222 13.2222 14.2222 15.2222 16.2222 17.2222 18.2222 19.2222 20.2222
(:,:,4) =									
2.3333 3.3333 4.3333 5.3333 6.3333 7.3333 8.3333 9.3333 10.3333 11.3333	3.3333 4.3333 5.3333 6.3333 7.3333 8.3333 9.3333 10.3333 11.3333 12.3333	4.3333 5.3333 6.3333 7.3333 8.3333 9.3333 10.3333 11.3333 12.3333 13.3333	5.3333 6.3333 7.3333 8.3333 9.3333 10.3333 11.3333 12.3333 13.3333 14.3333	6.3333 7.3333 8.3333 9.3333 10.3333 11.3333 12.3333 13.3333 14.3333 15.3333	7.3333 8.3333 9.3333 10.3333 11.3333 12.3333 14.3333 15.3333 16.3333	8.3333 9.3333 10.3333 11.3333 12.3333 14.3333 15.3333 16.3333 17.3333	9.3333 10.3333 11.3333 12.3333 13.3333 14.3333 15.3333 16.3333 17.3333 18.3333	10.3333 11.3333 12.3333 13.3333 14.3333 15.3333 16.3333 17.3333 18.3333 19.3333	11.3333 12.3333 13.3333 14.3333 15.3333 16.3333 17.3333 18.3333 19.3333 20.3333
(:,:,5) =									
2.4444 3.4444 4.4444 5.4444	3.4444 4.4444 5.4444 6.4444	4.4444 5.4444 6.4444 7.4444	5.4444 6.4444 7.4444 8.4444	6.4444 7.4444 8.4444 9.4444	7.4444 8.4444 9.4444 10.4444	8.4444 9.4444 10.4444 11.4444	9.4444 10.4444 11.4444 12.4444	10.4444 11.4444 12.4444 13.4444	11.4444 12.4444 13.4444 14.4444

6.4444	7.4444	8.4444	9.4444	10.4444	11.4444	12.4444	13.4444	14.4444	15.4444
7.4444	8.4444	9.4444	10.4444	11.4444	12.4444	13.4444	14.4444	15.4444	16.4444
8.4444	9.4444	10.4444	11.4444	12.4444	13.4444	14.4444	15.4444	16.4444	17.4444
9.4444	10.4444	11.4444	12.4444	13.4444	14.4444	15.4444	16.4444	17.4444	18.4444
10.4444	11.4444	12.4444	13.4444	14.4444	15.4444	16.4444	17.4444	18.4444	19.4444
11.4444	12.4444	13.4444	14.4444	15.4444	16.4444	17.4444	18.4444	19.4444	20.4444
(:,:,6) =									
2.5556	3.5556	4.5556	5.5556	6.5556	7.5556	8.5556	9.5556	10.5556	11.5556
3.5556	4.5556	5.5556	6.5556	7.5556	8.5556	9.5556	10.5556	11.5556	12.5556
4.5556	5.5556	6.5556	7.5556	8.5556	9.5556	10.5556	11.5556	12.5556	13.5556
5.5556	6.5556	7.5556	8.5556	9.5556	10.5556	11.5556	12.5556	13.5556	14.5556
6.5556	7.5556	8.5556	9.5556	10.5556	11.5556	12.5556	13.5556	14.5556	15.5556
7.5556	8.5556	9.5556	10.5556	11.5556	12.5556	13.5556	14.5556	15.5556	16.5556
8.5556	9.5556	10.5556	11.5556	12.5556	13.5556	14.5556	15.5556	16.5556	17.5556
9.5556	10.5556	11.5556	12.5556	13.5556	14.5556	15.5556	16.5556	17.5556	18.5556
10.5556	11.5556	12.5556	13.5556	14.5556	15.5556	16.5556	17.5556	18.5556	19.5556
11.5556	12.5556	13.5556	14.5556	15.5556	16.5556	17.5556	18.5556	19.5556	20.5556
(:,:,7) =									
2.6667	3.6667	4.6667	5.6667	6.6667	7.6667	8.6667	9.6667	10.6667	11.6667
3.6667	4.6667	5.6667	6.6667	7.6667	8.6667	9.6667	10.6667	11.6667	12.6667
4.6667	5.6667	6.6667	7.6667	8.6667	9.6667	10.6667	11.6667	12.6667	13.6667
5.6667	6.6667	7.6667	8.6667	9.6667	10.6667	11.6667	12.6667	13.6667	14.6667
6.6667	7.6667	8.6667	9.6667	10.6667	11.6667	12.6667	13.6667	14.6667	15.6667
7.6667	8.6667	9.6667	10.6667	11.6667	12.6667	13.6667	14.6667	15.6667	16.6667
8.6667	9.6667	10.6667	11.6667	12.6667	13.6667	14.6667	15.6667	16.6667	17.6667
9.6667	10.6667	11.6667	12.6667	13.6667	14.6667	15.6667	16.6667	17.6667	18.6667
10.6667	11.6667	12.6667	13.6667	14.6667	15.6667	16.6667	17.6667	18.6667	19.6667
11.6667	12.6667	13.6667	14.6667	15.6667	16.6667	17.6667	18.6667	19.6667	20.6667
(:,:,8) =									
2.7778	3.7778	4.7778	5.7778	6.7778	7.7778	8.7778	9.7778	10.7778	11.7778
3.7778	4.7778	5.7778	6.7778	7.7778	8.7778	9.7778	10.7778	11.7778	12.7778
4.7778	5.7778	6.7778	7.7778	8.7778	9.7778	10.7778	11.7778	12.7778	13.7778
5.7778	6.7778	7.7778	8.7778	9.7778	10.7778	11.7778	12.7778	13.7778	14.7778
6.7778	7.7778	8.7778	9.7778	10.7778	11.7778	12.7778	13.7778	14.7778	15.7778
7.7778	8.7778	9.7778	10.7778	11.7778	12.7778	13.7778	14.7778	15.7778	16.7778
8.7778	9.7778	10.7778	11.7778	12.7778	13.7778	14.7778	15.7778	16.7778	17.7778
9.7778	10.7778	11.7778	12.7778	13.7778	14.7778	15.7778	16.7778	17.7778	18.7778
10.7778	11.7778	12.7778	13.7778	14.7778	15.7778	16.7778	17.7778	18.7778	19.7778
11.7778	12.7778	13.7778	14.7778	15.7778	16.7778	17.7778	18.7778	19.7778	20.7778
(
(:,:,9) =									
2.8889	3.8889	4.8889	5.8889	6.8889	7.8889	8.8889	9.8889	10.8889	11.8889
3.8889	4.8889	5.8889	6.8889	7.8889	8.8889	9.8889	10.8889	11.8889	12.8889
4.8889	5.8889	6.8889	7.8889	8.8889	9.8889	10.8889	11.8889	12.8889	13.8889
5.8889	6.8889	7.8889	8.8889	9.8889	10.8889	11.8889	12.8889	13.8889	14.8889
6.8889	7.8889	8.8889	9.8889	10.8889	11.8889	12.8889	13.8889	14.8889	15.8889
7.8889	8.8889	9.8889	10.8889	11.8889	12.8889	13.8889	14.8889	15.8889	16.8889
8.8889	9.8889	10.8889	11.8889	12.8889	13.8889	14.8889	15.8889	16.8889	17.8889
9.8889	10.8889	11.8889	12.8889	13.8889	14.8889	15.8889	16.8889	17.8889	18.8889
10.8889	11.8889	12.8889	13.8889	14.8889	15.8889	16.8889	17.8889	18.8889	19.8889
11.8889	12.8889	13.8889	14.8889	15.8889	16.8889	17.8889	18.8889	19.8889	20.8889

(:,:,10) =

```
3
               5
                             7
                                           9
        4
                      6
                                    8
                                                 10
                                                        11
                                                               12
 4
        5
                      7
                             8
                                    9
                                          10
                                                        12
               6
                                                 11
                                                               13
 5
               7
                             9
        6
                      8
                                   10
                                          11
                                                 12
                                                        13
                                                               14
                      9
 6
        7
               8
                            10
                                   11
                                          12
                                                 13
                                                        14
                                                               15
 7
        8
               9
                    10
                            11
                                   12
                                          13
                                                        15
                                                               16
 8
       9
             10
                                   13
                    11
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                                          14
                                                 15
                                                        16
                                                               17
9
      10
             11
                    12
                            13
                                   14
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                                                               18
10
      11
             12
                    13
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                                          16
                                                 17
                                                        18
                                                               19
11
      12
             13
                    14
                           15
                                   16
                                          17
                                                 18
                                                        19
                                                               20
12
      13
              14
                    15
                            16
                                   17
                                          18
                                                 19
                                                        20
                                                               21
```

Given integer arrays, all possible combinations

given any sizes arrays, N of them, create all possible combinations

```
ar_it_a = 1:3;
ar_it_b = 1:2;
ar_it_c = 2:4;
ar_it_d = -1:-1:-2;
ar_it_e = 0.1;
cl_ar_all = {ar_it_a, ar_it_b, ar_it_c, ar_it_d, ar_it_e};
cl_mt_all = cl_ar_all;
[cl_mt_all{:}] = ndgrid(cl_ar_all{:});
mt_it_allcombo = cell2mat(cellfun(@(m) m(:), cl_mt_all, 'uni', 0));
disp(mt_it_allcombo)
```

```
1.0000
          1.0000
                     2.0000
                               -1.0000
                                           0.1000
2.0000
          1.0000
                     2.0000
                               -1.0000
                                           0.1000
3.0000
          1.0000
                     2.0000
                               -1.0000
                                           0.1000
1.0000
           2.0000
                     2.0000
                               -1.0000
                                           0.1000
2.0000
           2.0000
                     2.0000
                               -1.0000
                                           0.1000
3.0000
           2.0000
                     2.0000
                               -1.0000
                                           0.1000
1.0000
          1.0000
                     3.0000
                               -1.0000
                                           0.1000
2.0000
          1.0000
                     3.0000
                               -1.0000
                                           0.1000
3.0000
          1.0000
                     3.0000
                               -1.0000
                                           0.1000
1.0000
          2.0000
                     3.0000
                               -1.0000
                                           0.1000
          2.0000
                     3.0000
                               -1.0000
2.0000
                                           0.1000
3.0000
          2.0000
                     3.0000
                               -1.0000
                                           0.1000
1.0000
                     4.0000
                               -1.0000
          1.0000
                                           0.1000
                                           0.1000
2.0000
          1.0000
                     4.0000
                               -1.0000
3.0000
          1.0000
                     4.0000
                               -1.0000
                                           0.1000
1.0000
          2.0000
                     4.0000
                               -1.0000
                                           0.1000
2.0000
          2.0000
                     4.0000
                               -1.0000
                                           0.1000
3.0000
          2.0000
                     4.0000
                               -1.0000
                                           0.1000
          1.0000
                     2.0000
                               -2.0000
1.0000
                                           0.1000
2.0000
          1.0000
                     2.0000
                               -2.0000
                                           0.1000
3.0000
          1.0000
                     2.0000
                               -2.0000
                                           0.1000
1.0000
          2.0000
                     2.0000
                               -2.0000
                                           0.1000
2.0000
          2.0000
                     2.0000
                               -2.0000
                                           0.1000
3.0000
          2.0000
                     2.0000
                               -2.0000
                                           0.1000
          1.0000
                               -2.0000
1.0000
                     3.0000
                                           0.1000
2.0000
          1.0000
                     3.0000
                               -2.0000
                                           0.1000
3.0000
           1.0000
                     3.0000
                               -2.0000
                                           0.1000
1.0000
           2.0000
                     3.0000
                               -2.0000
                                           0.1000
2.0000
           2.0000
                     3.0000
                               -2.0000
                                           0.1000
3.0000
          2.0000
                     3.0000
                               -2.0000
                                           0.1000
1.0000
          1.0000
                     4.0000
                               -2.0000
                                           0.1000
2.0000
          1.0000
                     4.0000
                               -2.0000
                                           0.1000
```

3.0000	1.0000	4.0000	-2.0000	0.1000
1.0000	2.0000	4.0000	-2.0000	0.1000
2.0000	2.0000	4.0000	-2.0000	0.1000
3.0000	2,0000	4.0000	-2.0000	0.1000