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)+zMVec(a);
end
```

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

(:,:,1) =

```
    2     3     4     5     6     7     8     9    10    11
    3     4     5     6     7     8     9    10    11    12
    4     5     6     7     8     9    10    11    12    13
    5     6     7     8     9    10    11    12    13    14
    6     7     8     9    10    11    12    13    14    15
    7     8     9    10    11    12    13    14    15    16
    8     9    10    11    12    13    14    15    16    17
    9    10    11    12    13    14    15    16    17    18
   10    11    12    13    14    15    16    17    18    19
   11    12    13    14    15    16    17    18    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   13.3333   14.3333   15.3333   16.3333
   8.3333    9.3333   10.3333   11.3333   12.3333   13.3333   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    6.4444    7.4444    8.4444    9.4444   10.4444   11.4444
   3.4444    4.4444    5.4444    6.4444    7.4444    8.4444    9.4444   10.4444   11.4444   12.4444
   4.4444    5.4444    6.4444    7.4444    8.4444    9.4444   10.4444   11.4444   12.4444   13.4444
   5.4444    6.4444    7.4444    8.4444    9.4444   10.4444   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     4     5     6     7     8     9    10    11    12
 4     5     6     7     8     9    10    11    12    13
 5     6     7     8     9    10    11    12    13    14
 6     7     8     9    10    11    12    13    14    15
 7     8     9    10    11    12    13    14    15    16
 8     9    10    11    12    13    14    15    16    17
 9    10    11    12    13    14    15    16    17    18
10    11    12    13    14    15    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

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