

## HW 3 Solution - ISE 754 Fall 2020

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### Question 1

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(see Basic Concepts)

### Question 2

---

#### (a)

---

```
[Name,ST,P,w] = ...  
    uscity10k('Name','ST','XY','Pop',mor({'NC','SC'},uscity10k('ST')));  
opt = optimset('fminsearch'); opt.MaxFunEvals = 1e8; opt.TolFun = 1e-8;  
% Two ways to calc minisum location:  
xy = fminsearch(@(x) sum(w(:)'.*dists(x,P,'mi')),mean(P,1),opt)  
xy = minisumloc(P,w(:)','mi')      % Matlog function
```

xy =

-80.1632    35.3415

```
xy =
```

```
-80.1632    35.3415
```

## (b)

---

Two ways to determine closest city:

```
d = dists(xy,P,'mi');  
Name(argmin(d))  
lonlat2city(xy,uscity10k) % Matlog function (default data USCITY50K)
```

```
ans =
```

```
1×1 cell array
```

```
{'Albemarle'}
```

```
xy is in Albemarle, NC
```

## (c)

---

```
Name(argmax(d))
```

```
ans =
```

```
1×1 cell array
```

```
{'Elizabeth City'}
```

## (d)

---

```
idx = argsort(d);  
Name(idx(1:4))
```

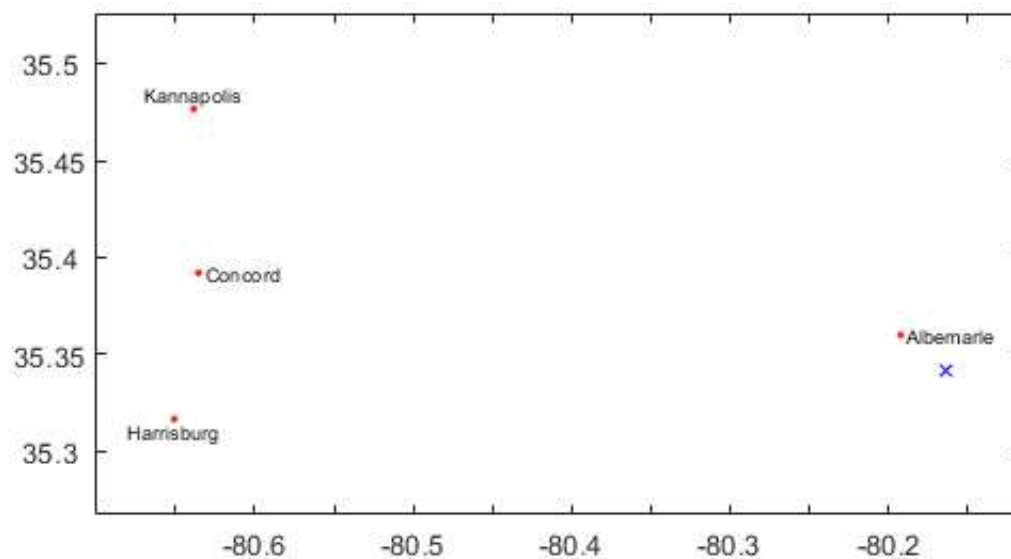
```
ans =
```

```
4×1 cell array
```

```
{'Albemarle' }  
{'Concord'   }  
{'Harrisburg'}  
{'Kannapolis'}
```

(e)

```
makemap([xy; P(idx(1:4),:)]))  
pplot(xy,'bx')  
pplot(P(idx(1:4),:),'r.')  
pplot(P(idx(1:4),:),Name(idx(1:4)))
```



(f)

```
disp(['The location is ' num2str(dists(xy,P(argmax(w),:),'mi')) ...  
     ' miles from the largest city, which is ' Name{argmax(w)} '.'])
```

The location is 38.7259 miles from the largest city, which is Charlotte.

(g)

```
idx50k = idx(w(idx) >= 50000);  
Name(idx50k(1))
```

ans =

1×1 cell array

```
{ 'Concord' }
```

**(h)**

---

```
100*sum(w(P(:,2) < xy(2)))/sum(w)
```

```
ans =
```

```
52.2926
```

**(i)**

---

```
sum(w(d <= 100))
```

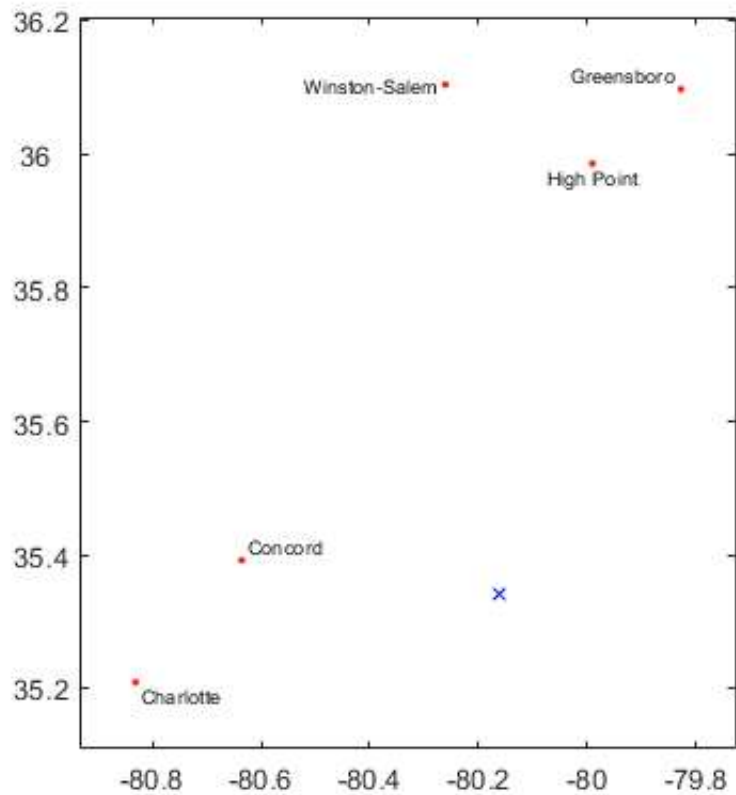
```
ans =
```

```
3900370
```

**(j)**

---

```
makemap([xy; P(idx50k(1:5),:)] )  
pplot(xy, 'bx')  
pplot(P(idx50k(1:5),:), 'r.')  
pplot(P(idx50k(1:5),:), Name(idx50k(1:5)))
```



(k)

```
idxDC = mand({'raleigh','char','north char'},Name,{'NC','NC','SC'},ST)
D = dists(P(idxDC,:),P,'mi');
W = sparse(argmin(D,1),1:length(w),w);
totalPop = full(sum(W,2))
```

idxDC =

```
66
12
117
```

totalPop =

```
2328977
2692248
702737
```

### Question 3

(a)

```
city2lonlat = @(city,st) ...
```

```
uscity('XY',mand(city,uscity('Name'),st,uscity('ST')));
P = city2lonlat({'Detroit','Gainesville','Memphis'},{'MI','FL','TN'})
f = [20 30 24];
xy = minisumloc(P,f,'mi')
```

P =

```
-83.1022    42.3830
-82.3459    29.6788
-89.9785    35.1035
```

xy =

```
-86.3345    34.5085
```

**(b)**

---

```
lonlat2city(xy)
```

xy is 22.30 mi SE of Huntsville, AL

**(c)**

---

```
lonlat2city(xy,uscity10k)
```

xy is 18.35 mi NW of Albertville, AL

**(d)**

---

```
D = dists(P,P,'mi');
g = mean([1057/D(1,2) 754/D(1,3) 719/D(2,3)]) % Using fastest rte per Gmap
```

g =

```
1.2165
```

**(e)**

---

```
r = 3.00;
TCopt = sum(f.*dists(xy,P,'mi')) * g * r
```

```
TCopt =

    1.0467e+05
```

**(f)**

```
xyCary = city2lonlat('Cary','NC');
TCcary = sum(f.*dists(xyCary,P,'mi')) * g * r;
increase = TCcary - TCopt;
vdisp('TCopt,TCcary,TCcary - TCopt')
```

```
      :      TCopt      TCcary      TCcary - TCopt
--:-----
1:  104,666.81  143,665.84      38,999.03
```