Winter 2014
Midterm

Question 5
Legend

<table>
<thead>
<tr>
<th>x</th>
<th>q</th>
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- **x**: Enough space in memory to hold an integer value. Here, referred to with the variable name \( x \).

- **q**: Enough space in memory to hold an address; also, the pointer is expected to point to an area in memory set aside to hold an integer value. Here, referred to with the variable name \( q \).

- \( *q \): Here, also referred to with \( *q \) or by dereferencing \( q \) (what does \( q \) point at?). On the right side of =, \( *q \) will give the value stored in \( x \) (the integer); on the left side of =, \( *q \) will give the location of \( x \) (exactly how \( x \) is interpreted on the right or left side of =).

- \( &x \): Here, the value stored in \( q \) is \( &x \) or the address of \( x \) (where in memory is \( x \) located?).
```c
int main() {
    int x;
    int y = 9;
    int z;
    int *q;
    int *r;
    int *s;
    q = &x;
    r = q;
    *r = 3;
    s = &y;
    z = 5;

    printf("xyz: %d, %d, %d\n", x, y, z);
    printf("*: %d, %d, %d\n", *q, *r, *s);
    unknown(&x, &y, &z);
    unknown(q, r, s);

    printf("xyz: %d, %d, %d\n", x, y, z);
    printf("*: %d, %d, %d\n", *q, *r, *s);
    unknown(&x, &y, &z);
    unknown(q, r, s);

    printf("xyz: %d, %d, %d\n", x, y, z);
    printf("*: %d, %d, %d\n", *q, *r, *s);
    unknown(&x, &y, &z);
    unknown(q, r, s);

    return 0;
}
```
Local declarations in main

```c
int main() {
    int x;
    int y = 9;
    int z;
    int *q;
    int *r;
    int *s;
    ...
}
```
```c
int main() {
  ...
  q = &x;
  r = q;
  *r = 3;
  s = &y;
  z = 5;
}
```
int main() {
    ... 
    printf("xyz: %d, %d, %d\n", x, y, z);
    printf("*: %d, %d, %d\n", *q, *r, *s);
    ... 

    XYZ: 3 9 5
    *: 3 3 9
First call to unknown in main

```c
int main() {
    ...
    unknown(&x, &y, &z);
    ...
}
```
void unknown(int *a, int *b, int *c) {
    *a = *b;
    *b = 42;
    *c = *a + *b;
}

First call to unknown(&x, &y, &z)
int main() {

    ...

    printf("xyz: %d, %d, %d\n", x, y, z);
    printf("*: %d, %d, %d\n", *q, *r, *s);

    ...

    XYZ: 9 42 51
    *: 9 9 42
Second call to unknown in main

```c
int main() {
  ...
  unknown(q, r, s);
  ...
}
```
Second call to unknown(q, r, s)

void unknown(int *a, int *b, int *c) {
    *a = *b;
    *b = 42;
    *c = *a + *b;
}
Third 2 printfs in main

```c
int main() {

    ...  

    printf("xyz: %d, %d, %d\n", x, y, z);
    printf("*: %d, %d, %d\n", *q, *r, *s);
    return 0;
}
```

XYZ: 42 84 51
*: 42 42 84