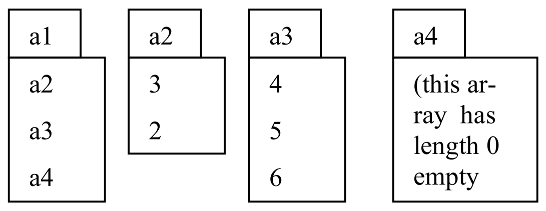
Question 1.

```
/** Let x be the value currently in b[h]. Permute
      b[h..k] and return an int j that satisfies
      b[h..j-1] <= b[j] = x < b[j+1..k]. */
public static int partition(int[] b, int h, int k) {
   int j= h;  int t= k;
   /* inv: b[h..j-1] <= b[j] = x <= b[t+1..k] */
   while (j < t) {
       if (b[j+1] <= b[j]) {
          Swap b[j+1] and b[j];    j= j+1;
       }
      else { Swap b[j+1] and b[t];    t= t-1;
      }
   }
   return j;
}
```

Question 2.

```
int p= h; int q= p;
while (q <= k)
    if  (b[q] % 2 != 0) {
       b[p]= b[q];
       p= p + 1;
    }
    q= q + 1;
}
```

Question 3a. h __a1__



3b. /** see exam for spec */

```
public static void swap(int [][] b, int n,
                        int h, int k, int p, int q) {
     for (int r= 0; r != n; r= r+ 1) {
        for (int c= 0; c != n; c= c+1) {
           // Swap b[h+r][k+c] with b[p+r][q+c]
           int temp= b[h+r][k+c];
           b[h+r][k+c]= b[p+r][q+c];
           b[p+r][q+c]= temp;
        }
     }
 }
```

Question 4.

```
/** = a string containing n occurrences of char c.
      Precondition: n ≥ 0 */
   public static String occ(int n, char c){
       if (n == 0)
          return "";
       return c + occ(n–1, c);
   }

 /** Eg. the call p("2A0B3V") produces "AAVVV".
    Pre: s contains an even number of chars,
          and the first of each pair is a digit.
    Produce a String that, for each pair "ic" where 'i'
    is a digit, contains i occurrences of char c.
      */
   public static String p(String s) {
      if (s.length() == 0)
         return "";
      return  occ(s.charAt(0)  –  '0',  s.charAt(1))  +
                 p(s.substring(2));
   }
```

Question 5. (a) super();

(b) 1. Create a folder of class Student; execute the constructor call Student(“Doe”, “Fall”, 2006); and yield as value of the expression the name of the new folder.

(c) s can be cast to Object, CornellPersonnel, and Student. Casting down to Student must be done explicitly, using (Student) s.

(d) The apparent class is CornellPersonnel; the real class is Student.

(e) v.get(i) **instanceof** Faculty

(f) **this** refers to the object (folder)—or rather its name-- in which it occurs.

(g) person’s name: a. Put in CornellPersonnel, with class Name.

b. Person’s address. In CornellPersonnel with class Address.

c. College they teach in: In Faculty, with class College.

d. Graduate degree program: In Grad, with class GraduateDegree.

e. Transcript: In Student, with class Transcript.

(h) A parameter is a variable that is declared in the header of a method. An argument is an expression that appears within the parentheses of a method call.

(i) fi can be referenced anywhere within class Faculty and nowhere else.

(j)
```
if (ob == null || !ob instanceof CornellPersonnel)
      return false;
  CornellPersonnell cp= (CornellPersonnel) ob;
  return  cp.name.equals(this.name) &&
          cp.address.equals(this.address);
```

Question 6.

```
public class Faculty {

…

 /** If this faculty member is not lec's mentor
       make this faculty member lec's mentor. */
 public void addMentee(Lecturer lec) {
  if (m.contains(lec))
      return;

  m.add(lec);
  lec.makeMentor(this);
 }

 /** Make sure that this faculty member is
    not lec's mentor –remove lec from this
    faculty member's list if necessary. */
 public void removeMentee(Lecturer lec) {
  if (!m.contains(lec))
      return;

  m.remove(lec);
  lec.removeMentor();
 }
}

public class Lecturer {

…

 /** Make f be this Lecturer's mentor
    (if f is already the mentor, there is nothing
    to do; if someone else is the mentor, first
    remove that mentor) */
 public void makeMentor(Faculty f) {
   if (mentor == f)
      return;

   if (mentor != null) {
      removeMentor();
   }

   mentor= f;
   f.addMentee(this);
 }

 /** If this lecturer has a mentor, remove
   that mentor. */
 public void removeMentor() {
   if (mentor == null)
      return;

   Faculty f= mentor;
   mentor= null;
   f.removeMentee(this);
 }
}
```

Question 7. (a) False. In Java, since 5 and 3 are of type **int**, the value of 5/3 is an **int**. In Matlab, there is no type **int**; 5 and 3 are of type **double**, and 5/3 is **double** division.

(b)
```
signs=  - cumprod (- ones(1,n));
num= ((1:n) .* ((1:n) + 1));
evens= 2 .* (1:n);
den= evens .* evens;
cumsum( signs .* (num ./ den) )
```