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TWO LATE DAYS USED

## PROBLEM SET I (CONT.)

### Part II (cont.)

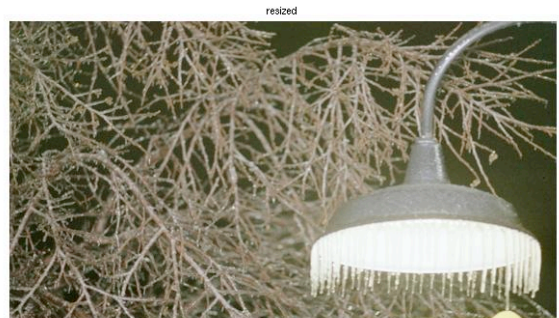
Photo Credits: The groceries, seals, and trees images were given. The image of the turtle pond was provided by Emily Russell. All other images are courtesy of Max Cornell.

5.)

#### Branches



This image was originally 512x768 pixels and is pictured to the left. I then removed 200 vertical seams, followed by 200 horizontal seams to yield a 312x568 image below and to the left. The resized equivalent image is below and to the right. The main difference between the images is that the seam carving found the branches to have a higher energy, and therefore reduced the streetlight, whereas a resized image still portrays the streetlight as a focal point.



#### Groceries

After that experiment, I decided to try alternating the horizontal and vertical seams. I took the original 375x500 groceries image pictured at right and removed 50 horizontal seams, followed by 50 vertical seams, followed by 100 horizontal seams, and ending with 100 more vertical seams. This resulted in a 225x350 image featured on the next page, at left. However, this

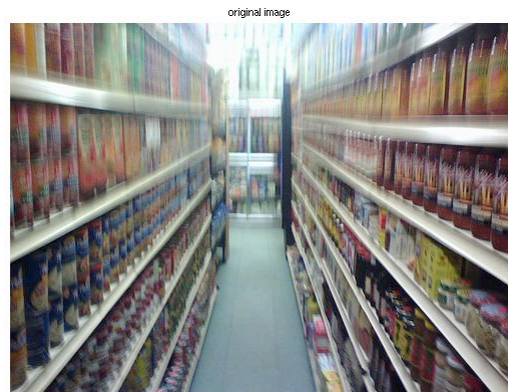
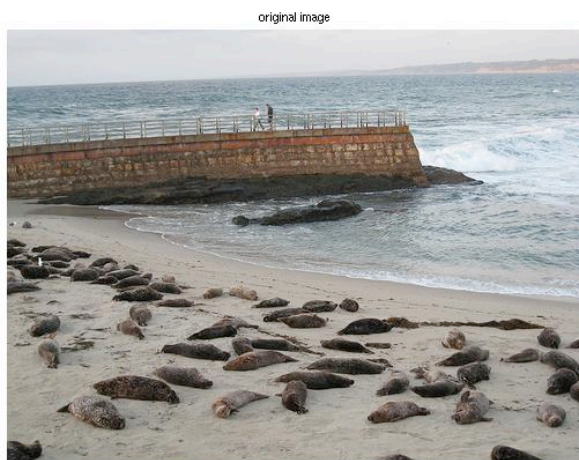




image proved to be a “bad” outcome. There seem to be too many lines and edges to find any low energy areas, and thus, the resized image at the right was a better yield. The seam carving approach favored the removal of the aisle and the shelves, rather than the store products, resulting in a distorted image.

### Seals



The original seals image, pictured at left, was 375x500 pixels. I then alternated removing vertical, and then horizontal seams in a 1:1 ratio for 150 pixels. This yielded the 225x350 image featured below and at left. For this image, seam carving worked remarkably well, as it kept the pier as a focal point, and clustered the seals, without removing or distorting them. The reduced image still appears entirely natural, and all major components were well preserved.



## Trees

With the seals image, alternating vertical and horizontal seams worked very well, so I decided to try that approach again. For the 375x500 image at right, I alternated horizontal and then vertical seam removals for 200 pixels to produce the 175x300 image below and at left. Compared to the resized image below and to the right, the seam carving preserved branches and sunny patches, while thinning the thicker branches and shadows.

original image



reduced



resized



## Beach

original image



reduced



resized



For the 512x768 image pictured at left, I continued to try alternating seam removals. This time, though, I removed two horizontal seams, and then one vertical seam for 125 iterations. This resulted in a 262x643 image featured below and to the left. For this image, the sky was greatly reduced, but the beach was very well preserved. The vertical seams, though, seemed to favor removal of rock components. This image had a good outcome.

## Chicago

Because the previous approach worked well for the beach image, I decided to try it again for the 512x768 image pictured at right. This time, though, I favored vertical seam removals, as I removed two for every horizontal seam removed, for 125 iterations. As a result, the 387x518 image below and to the left was produced. However, this image did not do well with the seam carving approach. There seem to be too many focal points, and not enough clear low-energy paths to find for removal. Thus explains the distorted and warped look that dominates the reduced image, in comparison with the resized image picture below and at right.



## Wall



Because of the distortion in the above image, I decided to next try a fairly "regular" image. The 483x725 image at left is comprised primarily of straight lines. Applying the exact same seam removals as detailed above yielded the 358x475 image featured at left on the following page. This time, the results were much better, in comparison with the resized image at right. The only distortion is a slight appearance of concavity to the building, but the stairs, windows, and cars were well preserved.

reduced



resized



### Turtle Pond

Finally, considering the first question asked, regarding reducing the width alone of the seals image, I decided to experiment with reducing the height alone. Therefore, I removed 150 horizontal seams from the 453x604 image at right to yield the 303x604 image featured below and at left. When comparing this with the resized equivalent image, however, it is hard to discern the difference. The only variation comes from identifying particular elements, which are well preserved, such as individual lily pads or plants that appear larger in the reduced image than in the resized one.

original image



reduced



resized

