COC202 Computer Vision
Lab 4 – Content-based image retrieval – Solutions

1.

```
function H = colourhist(image)
% generate 8x8x8 RGB colour histogram from image

    noBins = 8; % 8 bins (along each dimension)
    binWidth = 256 / noBins; % width of each bin
    H = zeros(noBins, noBins, noBins); % empty histogram to start with

    [n m d] = size(image);
    data = reshape(image, n*m, d); % reshape image into 2-d matrix with
one row per pixel

    ind = floor(double(data) / binWidth) + 1; % calculate into which bin
each pixel falls

    for i=1:length(ind)
        H(ind(i,1), ind(i,2), ind(i,3)) = H(ind(i,1), ind(i,2), ind(i,3))
+ 1; % increment bin
    end

    H = H / sum(sum(sum(H))); % normalise histogram
end
```

2.

```
function similarity = histint(h1, h2)

% histogram intersection

h1 = reshape(h1, prod(size(h1)), 1);
h2 = reshape(h2, prod(size(h2)), 1);
similarity = sum(min(h1, h2));
```

3.

```
% QBE with colour histograms

% create image datastore
imds = imageDatastore('.', 'FileExtensions', '.bmp');
imgs = readall(imds); % read in all images

% create colour histograms
for i=1:length(imgs)
    disp(sprintf('%2d - %s', i, imds.Files{i}));
    allhists(i,:,:,:) = colourhist(imgs{i});
end
sel = input('Select query image by number: ');

% compare query to database images
qhist = allhists(sel,:,:,:);
for i=1:length(imgs)
    mhist = allhists(i,:,:,:);
    sim(i) = histint(qhist, mhist);
end

% sort and display
[d, ind] = sort(sim, 'descend');
figure
for i=1:length(ind)
    subplot(10,10,i);
    imshow(imgs{ind(i)});
end
```

4. The colour histogram is calculated for the whole image, including the background, which for all images in the dataset is black and whose size varies across the images. Ignoring black should hence improve retrieval as then we will calculate the histogram only for the captured objects.

   The line

   ```
   H(1) = 0; % ignore black
   ```

   if inserted in the colour histogram function just before the histogram is normalised will do that (though in a rather crude way) and should lead to better results.