Q1: CT
Part a)
Most students correctly identified an appropriate threshold value, but quite a few people lost for marks for not stating HOW they had found this value. Further marks were lost if it was not made clear that DARK objects equals LOW values! It had to be made clear that the student had realised which way the inequality was going.

A sketch graph of the histogram with a labelling of the peaks as background/object, with a threshold in the dip between would have been a complete and concise answer to this part, but students seemed to prefer words instead! Although many students realised that all spanners were the same colour, quite a few did not realise that this was NOT the problem (identical, but separated spanners would have been okay), but that the OVERLAPPING/OCLUSION was the issue.

Part b)
A whole range of methods were suggested here, and even the slightly outlandish and improbable were evaluated, provided there was SOME argument as to why they might work.

To cover the most popular:
BLOB LABELLING: a lot of people gave a detailed account of blob labelling, and spotted that it would not deal with occlusion. Quite often, students failed to STATE EXACTLY how you could COUNT the spanners! For SIZE, just giving the AREA of a blob would have done! Perhaps students thought that this part could not be that easy/obvious? Note that max/min x&y are required to find bounding box hence size/orientation, just top& bottom are not enough!

SKELETONIZATION:
This was another popular option, although not everyone remembered to mention the ‘don’t break things apart’ criterion for the erosion. Also, people often assumed that the skeleton would be perfect, with none of the little spurs and odd little branches that you would actually see. So, pruning of the skeleton was rarely mentioned. Most people remembered to classify points by number of neighbours, and using this could hypothesize that crossings might show the occlusion. When it came to COUNTING, not everyone remembered to actually include this. SIZE and ORIENTATION were better done, with various possible suggestions about extreme points/end-points etc.

HOUGH TRANSFORM: This was a rather unexpected suggestion, probably prompted by the straight edges of the spanners. A long account of the Hough Transform itself did not necessarily obtain more marks, especially for students who had forgotten to mention at the start that it starts from EDGE IMAGES! Hence you’d have to find the edges of the blobs a priori.

Suggestions about finding pairs of parallel lines to count spanners were accepted, as were suggestions about orientation. Size, though, was a bit more elusive, since the Hough lines found don’t necessarily take this into account – but SIZE (length) could have been obtained, perhaps from the number of VOTES for each line! Widths from pairs of lines gained some marks. Correct reasoning about the method itself, and relation to the exact task in hand were rewarded more than just memorization & bookwork.

GRANULOMETRY/PAINTING THE FLOOR/OPENING & CLOSING
The ‘painting the floor’ idea was mentioned by many, but full marks were only given if the relation to erosion/dilation mentioned. Many people remembered the issue of oriented structure elements, although the specific ones in the lecture occurred more frequently than novel rectangular ones which might actually fit inside then handles of the spanners. Various attempts at granulometry style approaches, with varying size and orientation of structure element, rewarded more than just memorization & bookwork.

ACM/ASM etc – some people tried these, BUT most neglected to explain HOW they would actually answer the question asked (i.e. count, measure the size and orientation). For example, using ACM would only work if we first knew where each spanner was (so initial contour would be JUST around that spanner), but if we knew that we would have already answered the question! So not a solution, and unnecessary since we already HAVE a binary segmentation, we don’t need to segment the segmentation again!

Overall, the most frequent errors were neglecting to actually answer the question asked, & failing to include enough exact (& reasoned) detail as to how it could be done. This is the difference between reproducing some memorised detail, and actually thinking about the novel problem that had been presented!

Q2: CT
Part a)
This was a straightforward piece of bookwork, but many students perhaps misunderstood ‘representation of shape’, which was supposed to mean the mathematical representation of shape in terms of a shape vector. Even when ‘shape vector’ was mentioned, the mathematical form in terms of concatenated coordinates was not always included. Many students mentioned/defined ‘shape vector’ in the next part, and in this case, marks were carried backwards and included in the marks for part a).

Most people remembered landmarks and equally-spaced points. The problems with 3D were not always described, it was said that they could be hard, but NOT WHY they could be hard.

Part b)
This part of the question was standard bookwork, but some people failed to appreciate the fact that it was worth 8 marks, hence a considerable level of detail was expected. The most common errors were failing to explain exactly what happened during Procrustes alignment, exactly what PCA was, what the covariance matrix was, and what EIGENANALYSIS meant. Almost everyone forgot to mention the Gaussian probability distribution of the data.

In summary here, there was a noticeable gap between those who gave qualitative answers, and those who used equations/diagrams to give much more mathematically PRECISE descriptions of the steps needed.

Part c)
Again, the significance of build was not fully appreciated here, in that I asked how to build a model, not how the model worked once it was built. So, how search works in an ASM did not get full marks. Profile models were not described in great detail.

Part d)
Most people remembered about ACMs and concavities, but almost no one mentioned the MANY EDGES visible in this image. I think students were comparing it with the ACM in search on a cardiac image shown in the lectures,
where provided you had the best initialisation, it (almost) worked. With the ASM, most correctly said it would do best, but not many were sure as to WHY it would (the LEARNT aspect of shape was noticeably absent).

Question 3:
Generally, students did well in this question.

Question 4:
Generally well.
4© Few students were not able to tell the difference between interest points and local features. The description of an interest point detector (such as Harris corner detector of LoG/DoG) was required here, SIFT is not an interest point detector but a local feature descriptor.