The report:

This assignment requires of you to write a number of small programs in MATLAB or PYTHON (your choice) that illustrates the concepts of colour models and its use in colour images. (If you do not like MATLAB or PYTHON, you may use any other programming language of your choice which has sufficient capability for working with matrices and displaying images.)

MATLAB has built-in colour-conversion functions (such as RGB2HSI.m, etc.) and you may use them, but you must make sure that you understand exactly what such a function does.

You must write a short report discussing the questions and the results, and you must submit your code as an appendix. I put no limit on the number of pages — use a sensible number of pages for the task.

Your report must contain some illustrative examples of the results of all numbers. However, for question 1(a), a printout will be useless – one must view it on a screen. However, do append a photo of the result on the screen.

The assignment:

1(a) Write a program that will display parallel lines close to each other in two alternating primary colours (for example a red line followed by a green line, followed by a red line, followed by a green line, etc.). Your program must display patches where each of the pairs of primaries as well as all three primaries together are shown. The idea is then to view the screen from afar so that the observer senses the colour associated with the combination of those primaries. (This effect is quite successful.)

1(b) Do the same with the secondary colours (CYAN, MAGENTA, YELLOW), but print the result on a colour printer. (This effect is not so successful. Why? How can one improve it?)

2 Write a program that will assign a suitable name to a given RGB triplet. Your names must be a hue (such as 'RED','ORANGE','GREEN-YELLOW',BLUE-PURPLE', etc.) preceded by some adjectives (such as "light", "greyish", "dark", "creamy", etc.). Use your own imagination.

3 Write a program that can display a colour image, as well as any one of the primary colour plans (RED, GREEN, BLUE) and also the secondary planes (CYAN, MAGENTA, YELLOW), as well as the INTENSITY image. The particular colour plane must be shown in its own colour (not just in grey), and the intensity image must be shown in grey. Use 256 intensity levels everywhere.

4 The chromaticity diagram is given below. Assume that the diagram is according to scale. Answer the following by reading off coordinates from the diagram.
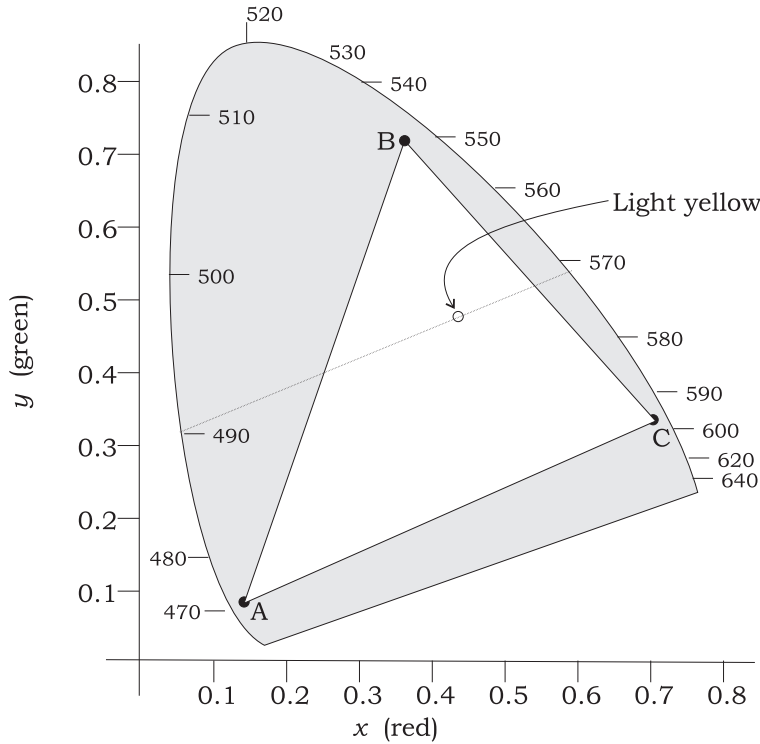
4(a) Write down the xyz values of the point denoted by "Light yellow".

The point "Light yellow" can be obtained by combining 71% of the pure spectrum colour $\lambda = 571$ nm and 29% of pure spectrum colour $\lambda = 490$ nm. The point "Light yellow" can also be obtained by combining two other pure spectrum colours. Which other pure spectrum colour must be used together with $\lambda = 590$ nm and how much of each should be used ?

4(b) A screen is illuminated by three colour channels given by A, B , and C as shown on the diagram. Which combination of A, B, and C will produce the colour "Light yellow" ?

5 A triangular display gamut is obtained by three colour points A, B, and C, inside the human colour gamut. The trichromatic coordinates of A, B and C are respectively (x_A, y_A), (x_B, y_B), and (x_C, y_C). Find a formulae (or set of formulae) for getting the trichromatic coordinate (x_0, y_0) of a colour obtained by mixing θ_A of A, θ_B of B, and θ_C of C. All $\theta_k \in [0, 1]$, $k = A, B, C$. The point (x_0, y_0) lies inside the triangular display gamut.