I. Separation of primary colors (subtractive & additive)

A. Separation of solid subtractive primary colors

1. Original has yellow, magenta, and cyan areas (use diagram)

2. Need to hold the target colors

    a) To hold a color, use the color's complementary color filter.

    b) To hold:

        (1) yellow, use a blue filter (passes blue, stops yellow)

        (2) magenta, use a green filter (passes green, stops magenta)

        (3) cyan, use a red filter (passes red, stops cyan)

            (a) presupposes the use of Panchromatic film

            (b) total darkness

            (c) find emulsion using notches

    c) Wherever the original was a primary color, the negative is clear

        (1) the black portion is a record of everything that is *not* the color on the original

3. Need to drop all non-target colors

    a) To drop a color, use the same color filter as the color you wish to drop.

        (1) a blue filter drops blue

        (2) a green filter drops green

        (3) a red filter drops red

4. Filter vs. printer

    a) Red-filter negative = cyan printer separation

    b) Green-filter negative = magenta printer separation

c) *Blue-filter negative = yellow printer separation*

B. Separation of solid additive primary colors

1. Original has red, green, and blue areas (use diagram)

2. Need to hold the target colors

   a) *Each additive primary must be held on two separations*

      (1) red is stopped by both the green and blue filters, thus it is held on both the yellow and magenta separations

      (2) blue is stopped by both the green and red filters, thus it is held on both the magenta and cyan separations

      (3) green is stopped by both the red and blue filters, thus it is held on both the yellow and cyan separations.

3. Need to drop non-target colors

II. Separation of non-solid or non-primary colors

A. Separation of all non-solid or non-primary colors is accomplished automatically through the halftone screen

1. Assumes that proper exposures are given.

B. Example of orange:

1. orange reflects both red and green (lot of red, some green)

   a) *the blue filter stops both the red and green, so the yellow-printer is predominantly clear in orange areas*

   b) *the red filter passes the strong red light, so the cyan-printer is predominantly black in orange areas.*

   c) *the green filter stops the red of the orange, but passes the green. Thus the magenta filter is partially exposed in the orange areas (composed of dots when a screen is used).*

C. Example of brown:

1. Brown reflects a little of each color

2. Each filter absorbs and transmits a little light from brown areas.

3. Each separation is partially exposed by brown areas

4. Each separation has halftone dots in brown areas.

III. Exposure considerations for separations

A. Need for filter factor

B. Adjustment of tonal range through the use of flash exposure and targeting of highlight dot

1. size and location of highlight dot

   a) 2–5% in highlight density for coated paper

   b) 8–10% in highlight density for uncoated paper

   c) For coated paper, Margulis recommends 5C2Y2M0K

   d) Cyan is always a larger dot to compensate for colorimetric deficiencies.

2. Shadow dots in each separation need not all be 90–95%—overlay combination darkens shadows

   a) Margulis recommends 80C70Y70M70K

   b) Cyan is always larger to compensate for colorimetric deficiencies

3. Mention length of blue-filter exposure

C. Compensation for poor colorimetric response of cyan ink

1. underexpose cyan printer

2. underexposed cyan printer is lighter—has more clear areas— that result in more cyan image

IV. The black-printer negative

A. Need for black-printer

1. compensate for washed-out shadows caused by overprints of inadequate CMY inks (especially C)

2. increase contrast

3. increase gamut

4. a neutral color that, if run too heavy or too light on a press, does not impact the color balance of the printed reproduction.

5. increases the number of ways that a given color can be reproduced (see chart on page 124 of Margulis)

B. Exposure of black-printer

1. The black-printer represents only the areas of the original that *contain no color!*

2. *Two ways of exposing the black-printer:*

   a) 3 exposures, once each with R, G, and B filters

   b) amber filter

3. result is very dark negative that contains very few clear areas.

C. Tonal-range of black printer

1. black-printers have no dots in the highlight areas

2. black-printer shadow dots are more open (overexposed on negative = smaller halftone dots) than other printers.

V. Removal of black component(s)

A. Replacement of overlapping percentages of yellow, magenta, and cyan ink with a equivalent amount of black ink.

B. Reasons to replace black components:

1. reduce amount of ink

2. black ink is cheaper than process-color inks

3. cuts drying time

4. improves trapping

5. more consistent color balance during pressrun

a) increasing or decreasing black density does not affect color balance.

C. Ways to remove black component

1. UCR: UnderColor Removal (Good example on pg. 46-47 of *How to Check and Correct Color Proofs)*

   a) Replacement of black components in shadows with black ink.

   b) In a solid black area, a conventional separation set could contain 100% each of CMYK, resulting in a 400% total ink coverage.

      (1) reducing the C and K to 70%, and Y and M to 60% will result in the same visual representation.

         (a) total ink coverage is now only 260%

            (i) separation is known as 260% UCR.

         (b) the 60 and 70% dots of each color each gain an average of 20%, becoming 80-90% dots

         (c) result is much closer to 400% total coverage than would be expected by the numbers.

   c) SWOP standards dictate total ink coverage cannot exceed 300%

      (1) many publications adjust this down to 280%

   d) In sheetfed offset, 320% total ink coverage is acceptable

2. GCR: Gray Component Replacement (Good example on pg. 46-47 of *How to Check and Correct Color Proofs)*

   a) Replacement of gray and black components in highlights, midtones, and shadows.

   b) A particular color may be produced by 52C35M47Y.

      (1) ± 35% of each color composes a neutral gray.

      (2) This color could be created using 17C0M12Y35K.

         (a) In reality, you'd need a bit more cyan

c) *In practice, separators do not replace* all *the gray component with black ink.*

(1) 50% GCR replaces half the gray component with black ink.

(2) Most popular GCR percentages range from 40–60%.

D. These techniques are only available using electronic scanning equipment: filters cannot selectively replace colors.

E. Black Component Replacement and PhotoShop

1. The black plate is generated when you convert from any 3-letter mode to CMYK.

2. You can choose the type of black-component replacement from the Preferences>Separation Setup dialog box.

   a) *UCR or GCR*

   b) *GCR options (see examples on page 129 of Margulis)*

   (1) medium is default

   (2) maximum, heavy, light and custom are options

   (3) none generates a separation without a black plate

3. If you wish to change the black-component replacement of any CMYK image, convert the image to a three-letter mode, change the Separation Setup dialog box, and re-separate the image into CMYK.

4. Total ink coverage is adjusted in the ink limits field of the Separation Setup dialog box.

5. Marulis' recommendations

   a) *In general, use light GCR*

   (1) Later, the curves of the black plate can be radically adjusted to assist in color correction.

   b) *Use more GCR when it is important to decrease total ink coverage or when a slight variation in the unwanted color could ruin a color image*

(1) the more black, the less chance for shifts in color balance

F. Downsides of black-component replacement

1. reduced density of darker colors
2. listless black solids
    a) solid blacks need an underlayer of color to darken them
3. less contrast due to lighter blacks
4. gloss of reproduction will be reduced
    a) less ink on surface

G. Undercolor Addition

1. Opposite of undercolor removal
2. Adds CMY under solid black areas to boost density of shadows.
3. Let separations go solid in shadows, or adjust curves to hit solid sooner.

VI. Screen angles

A. Lithography, letterpress, flexography

1. C = 105˚ (or 15˚)
2. M = 75˚
3. Y = 90˚
4. K = 45˚

B. Gravure

1. C = 105˚ (or 15˚)
2. M = 75˚
3. Y = 60˚
4. K = 45˚

C. Screen/Flexography special considerations

1. add 8˚ to screen angle if:

    a) If angles clash with screen fabric, causing moiré

    b) If pattern of antilox roller clashes with angles, causing moiré.