1. Computing the CPS.

The CPS is computed in a way that provides a measure of a cadet's performance relative to his or her peers. This is meant to adjust for variations in grading systems within and among the three programs.

a. The APSC, MPSC, and PPSC are standardized so they each have a mean of zero and standard deviation of one.

$$APS^* = \frac{APSC - APSC_{\text{Class Mean}}}{\sigma_{APSC}}$$

$$MPS^* = \frac{MPSC - MPSC_{\text{Class Mean}}}{\sigma_{MPSC}}$$

$$PPS^* = \frac{PPSC - PPSC_{\text{Class Mean}}}{\sigma_{PPSC}}$$

where σ_{APSC}, σ_{MPSC}, σ_{PPSC} are the standard deviations of the class's respective scores.

b. Standardizing the APSC, MPSC, and PPSC ensures that all cadets are evaluated based on their performance relative to their class. It accounts for the deviation of their score from the class average (mean) score. It rewards those who are further above the mean and penalizes those who are further below the mean.

c. Standardizing does affect determination of Honor Graduates (CPS >= 3.50). This award is meant to be given to cadets based on their performance relative to their peers, not based on an absolute number. Normalizing ensures that only those cadets who truly performed significantly better than their peers become the honor graduates.

d. The CPS is based on the weighted average of the cumulative program scores. The APSC contributes 55%, the MPSC contributes 30%, and the PPSC contributes 15%.

$$CPS^* = 0.55(APS^*) + 0.30(MPS^*) + 0.15(PPS^*)$$

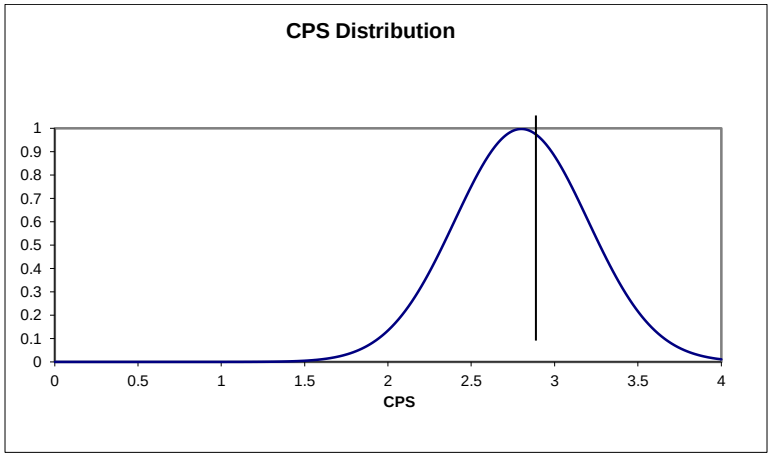
e. The weighted average of the standardized program scores, CPS^*, is a normally-distributed random variable with a mean equal to zero. To calculate a representative score on a 4.0 scale, CPS^* is standardized as follows (Z is the number of standard deviations above or below the class average):

$$Z = \frac{CPS^* - 0.0}{\sigma_{CPS^*}} = \frac{CPS^*}{\sigma_{CPS^*}}$$

f. Based on this result, the CPS is calculated to conform to a distribution with a mean of 2.8 and standard deviation of 0.40:

$$CPS = 0.40\,Z + 2.80$$

Using this mean and standard deviation ensures that 95% of cadets will have a CPS between 2.0 and 3.6 and 99.7% will be between 1.6 and 4.0. The top 4% of the class will have a CPS $\geq$ 3.5 and be designated as *Honor Graduates*.



2. Examples.

To illustrate why the program scores must be standardized, consider the following examples. Suppose the following situation exists:

Program scores

	Class Mean	Class Standard Deviation	Cadet A	Cadet B
APS	3.006	.513	3.006	3.326
MPS	3.017	.423	3.017	2.878
PPS	3.063	.340	3.063	3.454

a. **Example 1**. Cadet A is clearly average since his/her program scores are the same as the graduating class' program score averages. Without standardizing, Cadet A's CPS would be

$$CPS = .55(3.006) + .30(3.017) + .15(3.063) = 3.02$$

Cadet A's CPS should be the CPS class mean. In this case, it won't be because each program score has a different standard deviation. Without standardizing, the MPSC and PPSC scores were allowed to carry more weight than intended and allowed Cadet A to be considered above average. Cadet A's CPS after standardizing the program scores is:

$$CPS^* = .55(0.00) + .30(0.00) + .15(0.00) = 0.00$$

$$CPS = 0.40(0.00) + 2.8 = 2.8$$

In this case, Cadet A's CPS is the class average (mean).

b. **Example 2.** Cadet B's CPS is computed as follows:

$$APS^* = \frac{3.326 - 3.006}{.513} = 0.624$$
$$MPS^* = \frac{2.878 - 3.017}{.423} = -0.329$$
$$PPS^* = \frac{3.454 - 3.063}{.340} = 1.150$$
$$CPS^* = 0.55(0.624) + 0.30(-0.329) + 0.15(1.150) = 0.417$$

Using each cadet's CPS*, we can compute and verify that the class mean CPS* is zero and the standard deviation is 0.825. Cadet B's CPS* score is 0.417, which is clearly above average. Standardize CPS* and convert it to the 4.0 scale to find the CPS.

$$Z = \frac{0.417}{0.825} \approx 0.506$$
$$CPS = 0.40(0.506) + 2.80 = 3.002$$

Cadet B is above average (3.00 > 2.80).

c. **Example 3** (Are you really an Honor Graduate?). Suppose the following situation exists:

Program scores

	Class Mean	**Class Standard Deviation**	**Cadet C**
APS	3.183	.597	4.000
MPS	3.218	.404	2.895
PPS	3.089	.280	2.873

Cadet C appears to be very bright. Does well academically, but performs below average in the physical and military programs. Determine Cadet C's CPS without standardizing the program scores.

CPS = .55(4.000) + .30(2.895) + .15(2.873) = 3.50

In this case, Cadet C did so well academically that he/she is considered an Honor Graduate. However, this cadet did not truly perform significantly better than his/her peers. The Graduate Outcome Goal requires cadets to excel in all three programs. Now, compute the actual CPS

$$APS^* = \frac{4.000 - 3.183}{.597} = 1.369$$
$$MPS^* = \frac{2.895 - 3.218}{.404} = -0.800$$
$$PPS^* = \frac{2.873 - 3.089}{.340} = -0.635$$
$$CPS^* = 0.55(1.369) + 0.30(-0.800) + 0.15(-0.635) = 0.418$$

$$Z = \frac{0.418}{0.825} \approx 0.507$$
$$CPS = 0.40(0.507) + 2.80 = 3.00$$

Cadet C is above average (3.00 > 2.80), but not worthy of being an Honor Graduate.