Visual Step-by-Step Process of Conducting Two Independent Sample T-Test

***Problem*:** Using the Practice Dataset, determine if there is gender difference as it relates to systolic blood pressure (SBP) of the target population. Significance test is performed at the 0.05 significance level.

Null and Alternative Hypotheses: The null and alternative hypotheses are:
H_0: $\mu_M = \mu_F$ vs. H_1: $\mu_M \neq \mu_F$; where μ_M = mean SBP for males and μ_F= mean SBP for females.

Identification of Appropriate Statistical Method: Two Independent Sample T-Test. There are two independent groups defined by sex (male and female).

Data/Information Provided & Assumptions (if Applicable):
Data/Information: Based on the information provided in the problem the following information/data can be extracted

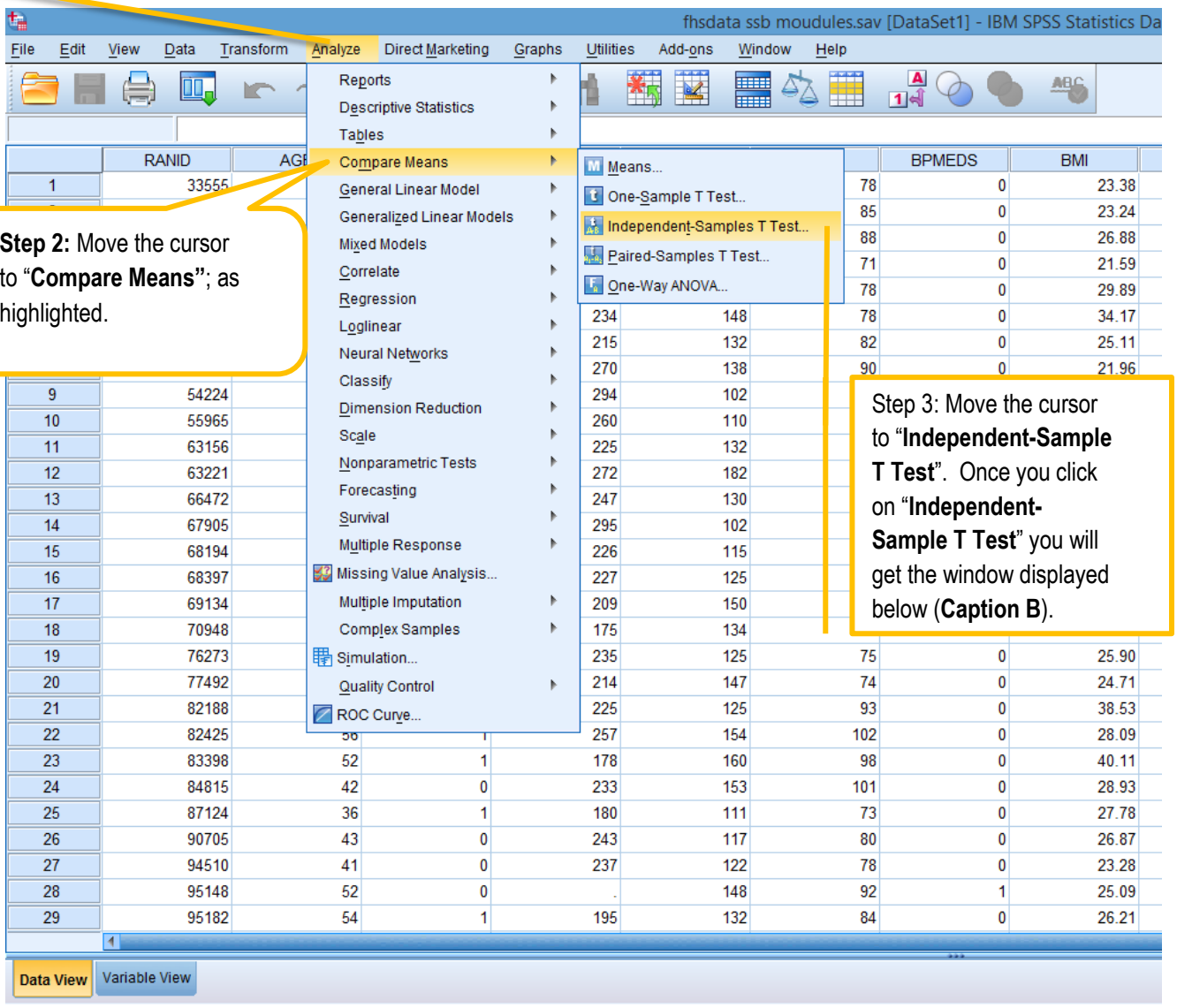
- Dependent variable: SBP; which is continuous
- Independent variable: two groups defined by sex.
- Significance level, α = 0.05
- Hypothesis is two-sided

Assumptions: The two independent sample t-test is valid if the following assumptions are satisfied.

- The data, SBP, is continuous.
- The probability distribution of SBP is normal.
- The independent variable should be categorical with independent two groups.
- The observation within and between the groups should be independent. This assumption is achieved by randomly selecting the samples from the two respective populations.
- Homogeneity of variances – the variances of the two groups should be the same. The Levene's Test of Equality of Variances is used to test for this assumption.

Conduct of Statistical Method:

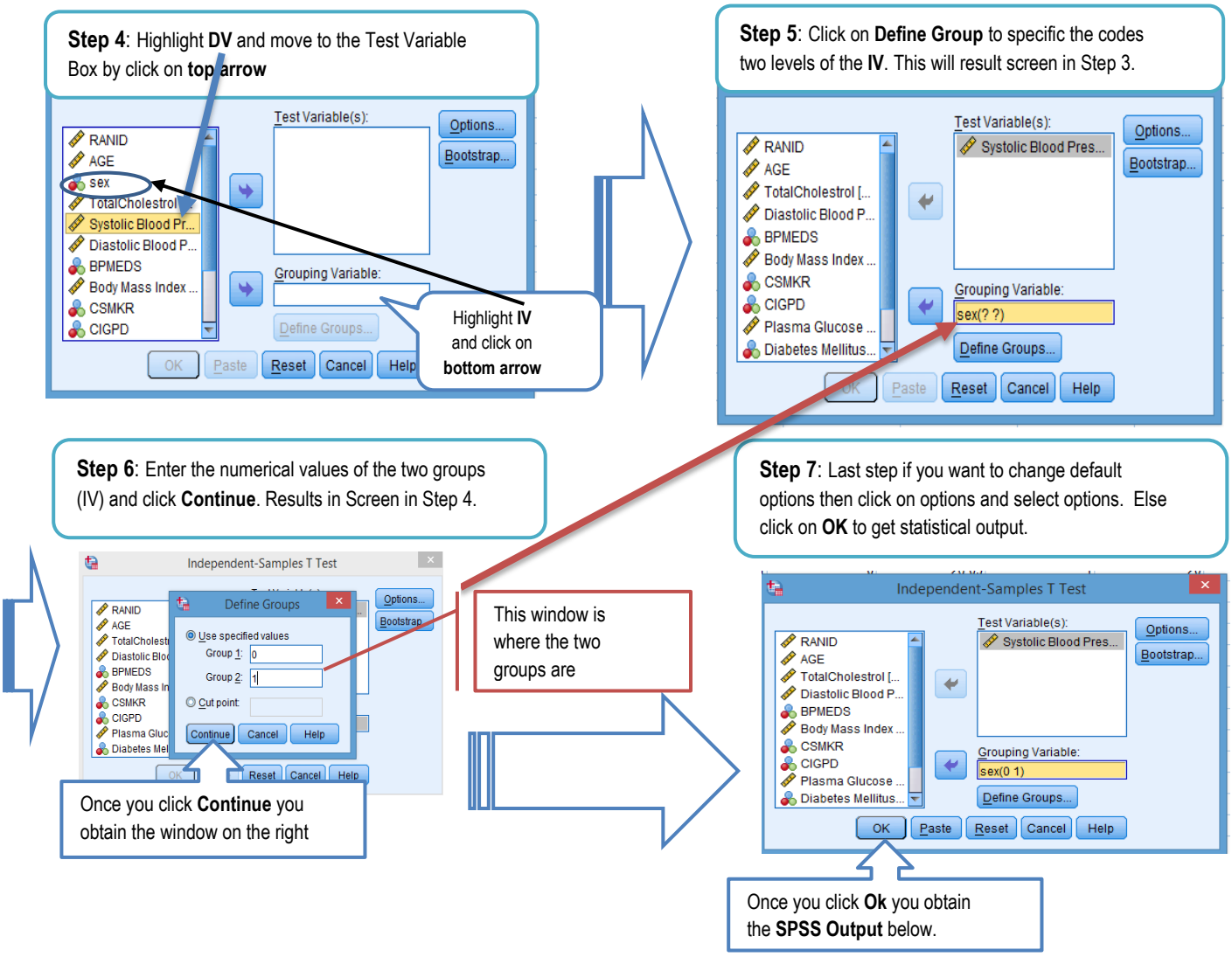
Step 1: Go to the header of the program and click on **Analyze** as highlighted (**Caption A**); and a menu of the statistical methods will be displayed as shown below.



Step 2: Move the cursor to "**Compare Means"**; as highlighted.

Step 3: Move the cursor to "**Independent-Sample T Test**". Once you click on "**Independent-Sample T Test**" you will get the window displayed below (**Caption B**).

Caption B



SPSS Output for Independent Two-Sample T-Test

Group Statistics

	sex	N	Mean	Std. Deviation	Std. Error Mean
Systolic Blood Pressure	Female	61	136.98	26.501	3.393
	Male	39	130.76	16.461	2.636

Mean difference in favor of female is 6.219

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Systolic Blood Pressure	Equal variances assumed	9.301	.003	1.311	98	.193	6.219	4.742	-3.192	15.630
	Equal variances not assumed			1.447	97.946	.151	6.219	4.297	-2.307	14.745

Since p=0.003 < 0.05, it implies the variances are unequal.

Since the p=0.151 > 0.05, H_0 is not rejected; hence conclusion favors H_1.

Interpretation of Findings:

To test the H_0: $\mu_M = \mu_F$ vs. H_1: $\mu_M \neq \mu_F$ with an independent two-sample t-test we first must examine the Levene's test of equality of variance to determine if the variances of the two groups are the same (H_0:$\sigma_M^2 = \sigma_F^2$ vs. H_1: $\sigma_M^2 \neq \sigma_F^2$). Since the p-value value of the Levene's Test of Equality of Variances equals 0.003, which is less than 0.05 (0.003 < 0.05), the test is significant hence we reject H_0:$\sigma_M^2 = \sigma_F^2$and conclude for H_1:$\sigma_M^2 \neq \sigma_F^2$. The variances are unequal. Hence, we will use the unequal variance t-test to test the hypothesis: H_0: $\mu_M = \mu_F$ vs. H_1: $\mu_M \neq \mu_F$.

Since the p-value (p=0.151) associated with the unequal variance t-test we fail to reject H_0: $\mu_M = \mu_F$ and conclude there is no significant difference in systolic blood pressure between men and women.