**Question 2. (20 points)**

Use Boolean algebra to solve the following questions. Show clearly all your steps.

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| 1. Simplify each of the following Boolean functions to the specified number of literals:

 1. $F1=x +\overline{x} y $ **(2 literals) (2 points)**
2. $F2=x y +x \overline{y} z+\overline{x} \overline{y}+x \overline{z} $ **(2 literals) (4 points)**
3. $F3=x \overline{w} \left( \overline{z}+\overline{y} z\right)+x (w+\overline{w} y z)$ **(1 literal) (4 points)**
4. $F4=\overbar{\left(x+\overline{y}\right)} \overbar{\left(x y+\overline{x} z\right)}$ **(3 literals) (3 points)**

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| 1. Given the Boolean function $F\left(X,Y,Z\right)=\left(X Y+\overbar{Z}\right)\left(\overbar{X}+Y\right)$: **(5 points)**
2. Express F as a **product-of-maxterms**, $F=\prod\_{}^{}M$.
3. Find the ***algebraic* sum-of-minterms** expression for *F*.

 1. Given the following Boolean function expressed using sum-of-products representation. $F\left(X,Y,Z\right)=X Y+ \overbar{X} Z$, express F as a product-of-sums (NOT as product-of-maxterms) representation. **(2 points)**
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