2018 Special Camp - Mock Marking Scheme

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1 Problem 1

Let $f(n)$ be the minimum number of terminals needed for a given n.

- **2 points:** Proving $f(1) = 6$.
  - **1 point** awarded only if proof isn't elaborated (such as only stating that $R(3,3) = 6$.
- **1 point:** Proving $f(n) > 4n$.
- **4 points:** Proving $f(n) = 4n + 1$ is valid for $n > 1$.
  - **1 point:** Considering vertices with degree $< 2n$.
  - **1 point:** Considering vertices with degree $> 2n$.
  - **1 point:** Considering vertices with degree $2n$.
  - **1 point:** Conclusion.

2 Problem 2

The following equations are key to the proof, and referred in the scheme:

$$P(-f(y), y) \Rightarrow f(-f(y)) = f(y)^4 + f(0) \tag{1}$$

$$P(-f(y), x) \Rightarrow f(f(x) - f(y)) - f(-f(y)) = (f(x) - f(y))^4 - f(y)^4 \tag{2}$$

$$P(-f(y), y) + P(-f(y), x) \Rightarrow f(f(x) - f(y)) = (f(x) - f(y))^4 + f(0) \tag{3}$$

- **3 points:** Fact A - Proving $f(s) - f(r)$ is surjective.
  - **Upto 1 point** awarded for considering polynomials of the form $(x+u)^4 - x^4 = t$
- **3 points:** Fact B - Finding Equation 3.
  - **1 point** for writing all possible solutions or finding either Equation 1 or Equation 2.

  - **+1 point** for writing all possible solutions AND finding Equation 1 and Equation 2.
  - **+1 point** for using Equation 1 and Equation 2 to deduce Equation 3.
- **1 point:** Concluding from facts A and B, or stating the intention of using this claim.

3 Problem 3

- **1 point:** Defining > 2 intersections of (ABP) or (CDP) with AD or BC. (Henceforth $WXYZ$).
- **3 points:** $ABCD, P \sim WXYZ, P$.
- **1 point:** Considering ratios from $J = AD \cap BC$.
- **1 point:** $CY \parallel DZ$ or $AW \parallel BX$.
- **1 point:** Angle Chasing to conclude.
- **-1 point** for not considering both if and only if directions.