Simplify the following expressions to their simplest disjunctive normal form (DNF) (e.g. sum of products). Provide the steps you used to simplify and give the justification in terms of the Boolean summary sheet provided. 3 points per problem (1 free point for turning in homework).

Example Solution:

0. $a + b + \bar{b}$

$$a + b + \bar{b} = a + (b + \bar{b}) \{\{7a\}\} = a + 1\{\{5a\}\} = 1\{\{2a\}\}$$

1. $a + \bar{a}$
2. $a \cdot \bar{a}$
3. $a + b \cdot \bar{b}$
4. $a + \overline{b \cdot \bar{b}}$
5. $a + a \cdot b$
6. $a + \bar{a} \cdot b$
7. $(a + b) \cdot \overline{(c \cdot d)} + (a + b) \cdot (c \cdot d)$
8. $a \cdot b + a \cdot b \cdot c + a \cdot b \cdot c \cdot d$
9. $a(\bar{a} + b)$
10. $a \cdot b + a \cdot \bar{b}$
11. $\bar{a} + \bar{a} \cdot b$
12. $(a + \bar{b}) \cdot (a + b)$
13. $(\bar{a} + \bar{b}) \cdot (\bar{a} + b)$
14. $(a + \bar{b} + c + \bar{d}) \cdot c$
15. $\overline{(\bar{a} + \bar{a})}$
16. $\overline{(a + \bar{a})}$
17. $a \cdot c + \bar{a} \cdot b + b \cdot c$
18. $a + (a \cdot \bar{b} \cdot c \cdot d)$
19. $\bar{a} \cdot \overline{(a \cdot b \cdot c \cdot d)}$
20. $a + \overline{(a \cdot b)} + b$
21. $a + \bar{a} \cdot \bar{b} + b$
22. $a \cdot (a + a \cdot b)$
23. $a \cdot (a + b + c + d + e)$
24. $(a + c) \cdot (\bar{a} + b) \cdot (b + c)$
25. $\bar{a} + \bar{b} + a \cdot b \cdot \bar{c}$
26. $a \cdot b \cdot (\bar{a} + \bar{b} + c)$
27. $\bar{a} \cdot (a \cdot b + b \cdot c + \bar{a} \cdot c)$
28. $\bar{c} \cdot (a \cdot b + b \cdot c + \bar{a} \cdot c)$
29. $b \cdot (a + \bar{b} \cdot c + c) + \bar{a} \cdot c$
30. $a \cdot c + c \cdot (\bar{a} + a \cdot c)$
31. $\overline{(a \cdot b)} \cdot \overline{(b \cdot c)} \cdot (a + \bar{c})$
32. $(b + c + d) \cdot (a + b + c) \cdot (\bar{a} + c + d) \cdot (\bar{b} + \bar{c} + \bar{d})$
33. $b \cdot \bar{c} \cdot \bar{d} + a \cdot b \cdot \bar{c} + a \cdot \bar{c} \cdot d + a \cdot \bar{b} \cdot d + \bar{a} \cdot b \cdot \bar{d}$