

* Write a regular expression for the following.

1. The set of all strings with an even no. of 0's

→ $1^* + (1^* 0 1^* 0)^* 1^*$

2. The set of all strings of even length (length multiple of 2)

→ $[(0+1)^2]^*$

3. The set of all strings divisible by 2.

→ $110(1+0)^*$

4. The set of all strings containing exactly three 1's.

→ $0^* 1 0^* 1 0^* 1 0^*$

5. The set of all strings divisible by 2.

→ $(0+1)^* 0$

6. The set of all strings whose third last symbol is 1.

→ $(1+0)^* 1 (1+0) (1+0)$

7. The set of strings containing ab as a substring

→ $(a+b)^* ab (a+b)^*$

8. Binary numbers that begin & end with the same digit.

→ $a(0+1)^* 0 + 1(0+1)^* 1$

9. All strings of a's & b's that contain no three consecutive b's.

→ $(a+ba+bb a)^* + b + bb$

10. Binary number that are twice an odd number (i.e.) binary representation of $2n$ where n is an odd no.
 $\rightarrow (0+1)^*10$

11. Binary string contains the sequence 011.
 $\rightarrow (1+0)^*01(0+1)^*$

12. Binary string contains substrings 010 & 101
 $\rightarrow (1+0)^*010(0+1)^* + (0+1)^*101(0+1)^*$

13. Binary strings does not contain substring 0110
 $\rightarrow 1^*0^*(1+11)^*0^*1^*$

14. Binary strings has an even number of 0s & an even number of 1s.
 $\rightarrow (00+11)^*(01+10)(00+11)^*(01+10)(00+11)^*$

15. Binary strings containing at least one 00 & at least one 11.
 $\rightarrow (0+1)^*00(0+1)^*11(0+1)^* + (0+1)^*11(0+1)^*00(0+1)^*$

16. Binary strings with at least two occurrences of at least two consecutive is the two occurrences not using adjacent.
 $\rightarrow (0+1)^*11(0+1)^*0(0+1)^*11(0+1)^*$

17. Strings over $\{a, b, c\}$ in which the fourth symbol from beginning is a c
 $\rightarrow (a+b+c)(a+b+c)(a+b+c)c$
 $(a+b+c)^*$

18. Strings over $\{a, b\}$ with an even number of a's
→ $b^*(ab^*ab^*)^*$

19. Strings over $\{a, b\}$ with atmost three a's.
→ $b^*(a+\epsilon)b^*(a+\epsilon)b^*(a+\epsilon)b^*$

20. Strings over $\{a, b\}$ of the form $a^n b^{2m}$ where n, m are +ve integers.
→ $(aa)^*(bb)^*$

21. Strings of the form $a^n b^m c^k$ where $n+m$ is odd & k is even.
→ $(aa)^*(bb)^*b(cc)^*(aa)^*a(bb)^*(cc)^*$