Example 1: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w contains only a's or only b's of length zero or more.

Solution: $r=a^{*}+b^{*}$

Example 2: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings $w$ such that, $w$ is of length one or more and contains only a's or only b's. $r=a++b+$

Solution: $r=a^{+}+b^{+}$

Example 3: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w contains zero or more a's followed by zero or more b's

Solution: $\mathrm{r}=\mathrm{a}$ * $\mathrm{b}^{*}$

Example 4: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w of length even

Solution: $\mathrm{r}=[(\mathrm{a}+\mathrm{b})(\mathrm{a}+\mathrm{b})]^{*}$

Example 5: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w of length odd

Solution: $\mathrm{r}=(\mathrm{a}+\mathrm{b})[(\mathrm{a}+\mathrm{b})(\mathrm{a}+\mathrm{b})]^{*}$

Example 6: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w of length three

Solution: $\mathrm{r}=(\mathrm{a}+\mathrm{b})(\mathrm{a}+\mathrm{b})(\mathrm{a}+\mathrm{b})$

Example 7: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w of length atmost three

Solution: $r=(a+b+\in)(a+b+\in)(a+b+\in)$

Example 8: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w of length odd containing only b's

Solution: $\mathrm{r}=(\mathrm{bb})^{*} \mathrm{~b}$

Example 9: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, $w$ starting with a always

Solution: $r=a(a+b)^{*}$

Example 10: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w starting and ending with b and having only a's in between.

Solution: $r=b a * b$

Example 11: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings
w such that, w starting and ending with same double letter

Solution: $r=\left\{(a a(a+b) * a a) \mid\left(b b(a+b)^{*} b b\right)\right.$

Example 12: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w with starting and ending with different letters

Solution: $r=\left(a(a+b)^{*} b\right) \mid\left(b(a+b)^{*} a\right)$

Example 13: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w with at least two occurrence of a

Solution: $r=(a+b)^{*} a(a+b)^{*} a(a+b)^{*}$

Example 14: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w with exactly two occurrence of a

Solution: $r=b^{*} a b^{*} a b^{*}$

Example 15: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w with at most two occurrence of a

Solution: $r=b^{*}(a+\in) b^{*}(a+\in) b^{*}$

Example 16: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings $w$ such that, $w$ with begin or end with aa or bb

Solution: $r=\left((a a+b b)(a+b)^{*}\right)+((a+b) *(a a+b b))$

Example 17: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, $w$ with begin and end with aa or bb

Solution: $r=\left((a a+b b)(a+b)^{*}(a a+b b)\right)+a a+b b$

Example 18: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings
w such that, w with total length multiple of 3 always

Solution: $\mathrm{r}=[(\mathrm{a}+\mathrm{b})(\mathrm{a}+\mathrm{b})(\mathrm{a}+\mathrm{b})]^{*}$

Example 19: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w containing total a's as multiple of 3 always

Solution: $\mathrm{r}=\left[\mathrm{b}^{*} \mathrm{a} \mathrm{b}^{*} \mathrm{a} \mathrm{b}^{*} \mathrm{a} \mathrm{b}^{*}\right]^{*}$

Example 20: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, $w$ with exactly two or three b's

Solution: $\mathrm{r}=\mathrm{a*} \mathrm{~b} \mathrm{a}^{*} \mathrm{~b} a *(\mathrm{~b}+\in) \mathrm{a}^{*}$

Example 21: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, $w$ with number of a's even

Solution: $r=b^{*}+\left(b^{*} a b^{*} a b^{*}\right)^{*}$

Example 22: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, $w$ in which $b$ is always tripled

Solution: $r=(a+b b b)^{*}$

Example 23: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w with at least one occurrence of substring aa or bb

Solution: $r=(a+b)^{*}(a a+b b)(a+b)^{*}$

Example 24: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings $w$ such that, $w$ with at the most one occurrence of sub-string bb

Solution: $\mathrm{r}=(\mathrm{a}+\mathrm{ba})^{*}(\mathrm{bb}+\in)(\mathrm{a}+\mathrm{ab})^{*}$

Example 25: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings
w such that, w without sub-string ab

Solution: $r=b^{*} a^{*}$

Example 26: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, $w$ without sub-string aba

Solution: $r=(a+\in)(b+a a+)^{*}(a+\in)$

Example 27: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings $w$ such that, $w$ in which $3 r d$ character from right end is always a

Solution: $r=(a+b)^{*} a(a+b)(a+b)$

Example 28: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings $w$ such that, $w$ always start with ' $a$ ' and the strings in which each ' $b$ ' is preceded by ' $a$ '.

Solution: $(a+a b)^{*}$

Example 29: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w contains atleast one ' $a$ '.

Solution: $(a+b)^{*} a(a+b)^{*}$

Example 30: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings $w$ such that, $w$ contain atleast two 'a's or any number of 'b's.

Solution: (a* $\left.a b^{*} a b^{*}\right)+b^{*}$

Example 31: Let $\Sigma=\{a, b\}$. Write regular expression to define language consisting of strings w such that, w contain atleast one 'a' followed by any number of 'b's followed by atleast one ' c '.

Solution: $a^{+} b^{*} c^{+}$

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