3)Lets prove that convex$\{+1,-1\}^d = \{x \in R^d : -1 \leq x_i \leq 1$, for all $1 \leq i \leq d\}$:

I will check first convex$\{+1,-1\}^d \subseteq \{x \in R^d : -1 \leq (x)_i \leq 1$, for all $1 \leq i \leq d\}$: Let $v_1, v_2, ..., v_{2^d}$ be any order of the points in the set $\{+1,-1\}^d$. Let $x \in$ convex$\{+1,-1\}^d$, so we write $x = \lambda_1 v_1 + \lambda_2 v_2 + ... + \lambda_{2^d} v_{2^d}$, where $\lambda_1 + \lambda_2 + ... + \lambda_{2^d} = 1$, and $\lambda_j \geq 0$ for all j. Observe that $(x)_i = (\lambda_1 v_1 + \lambda_2 v_2 + ... + \lambda_{2^d} v_{2^d})_i = \lambda_1 (v_1)_i + \lambda_2 (v_2)_i + ... + \lambda_{2^d} (v_{2^d})_i$; we know that $(v_k)_i \in \{+1, -1\}$ for $1 \leq k \leq 2^d$, so its also true that $-1 \leq (v_k)_i \leq 1$. Since $\lambda_k \geq 0$, using the previous inequality, we get $-\lambda_k \leq \lambda_k (v_k)_i \leq \lambda_k$, for all k. Addindg this inequalities we get $-(\lambda_1 + \lambda_2 + ... + \lambda_{2^d}) \leq (x)_i \leq (\lambda_1 + \lambda_2 + ... + \lambda_{2^d}) \Rightarrow -1 \leq (x)_i \leq 1$. Since the previous result holds for $1 \leq i \leq d$, we conclude $x \in \{x \in R^d : -1 \leq (x)_i \leq 1$, for all $1 \leq i \leq d\}$, so we have completed this part of the proof.

Now lets check $\{x \in R^d : -1 \leq (x)_i \leq 1$, for all $1 \leq i \leq d\} \subseteq \text{convex}\{+1, -1\}^d$:

Apply induction on d. The base case $d = 1$ is obvious, since $[-1, +1] = convex\{+1, -1\}$. Assume that the result its true for $d - 1$. Let $v_1, v_2, ..., v_{2^{d-1}}$ be any order of the points in the set $\{+1, -1\}^{d-1}$, now define $u_1 = (v_1, -1), u_2 = (v_2, -1), ..., u_{2^{d-1}} = (v_{2^{d-1}}, -1)$, and $w_1 = (v_1, +1), w_2 = (v_2, +1), ..., w_{2^{d-1}} = (v_{2^{d-1}}, +1)$, so $u_1, u_2, ..., u_{2^{d-1}}, w_1, w_2..., w_{2^{d-1}}$ are all the points of the set $\{+1, -1\}^d$. Let $x \in \{x \in R^d : -1 \leq (x)_i \leq 1$, for all $1 \leq i \leq d\}$, then $x = (\hat{x}, x_d)$, where $\hat{x} \in \{x \in R^{d-1} : -1 \leq (x)_i \leq 1\}$, and $x_d \in [-1, +1]$. By induction hypothesis $\hat{x} \in \text{convex}\{+1, -1\}^{d-1}$ so $\hat{x} = \lambda_1 v_1 + \lambda_2 v_2 ... + \lambda_{2^{d-1}} v_{2^{d-1}}$, a convex combination. Since $x_d \in [-1, +1]$, we know that $x_d = -1\mu + 1\lambda$ a convex combination. Now observe that $(\lambda_k \mu) u_k + (\lambda_k \lambda) w_k = \lambda_k (\mu(v_k, -1) + \lambda(v_k, +1)) = \lambda_k (v_k, x_d)$, for $1 \leq k \leq 2^{d-1}$, so we get that:

$$
\begin{aligned}
&(\lambda_1 \mu) u_1 + (\lambda_1 \lambda) w_1 + (\lambda_2 \mu) u_2 + (\lambda_2 \lambda) w_2 + ... + (\lambda_{2^{d-1}} \mu) u_{2^{d-1}} + (\lambda_{2^{d-1}} \lambda) w_{2^{d-1}} \\
&= \lambda_1 (v_1, x_d) + \lambda_2 (v_2, x_d) + ... + \lambda_{2^{d-1}} (v_{2^{d-1}}, x_d) \\
&= \big(\lambda_1 v_1 + \lambda_2 v_2 ... + \lambda_{2^{d-1}} v_{2^{d-1}}, (\lambda_1 + \lambda_2 + ... + \lambda_{2^{d-1}}) x_d\big) \\
&= (\hat{x}, x_d) = x.
\end{aligned}
$$

Since $(\lambda_1 \mu) + (\lambda_1 \lambda) + (\lambda_2 \mu) + (\lambda_2 \lambda) + ... + (\lambda_{2^{d-1}} \mu) + (\lambda_{2^{d-1}} \lambda) = (\mu + \lambda)(\lambda_1 + \lambda_2 + ... + \lambda_{2^{d-1}}) = 1$,and all of them are nonnegative, we conclude that $x \in \text{convex}\{+1, -1\}^d$. This complete the proof.