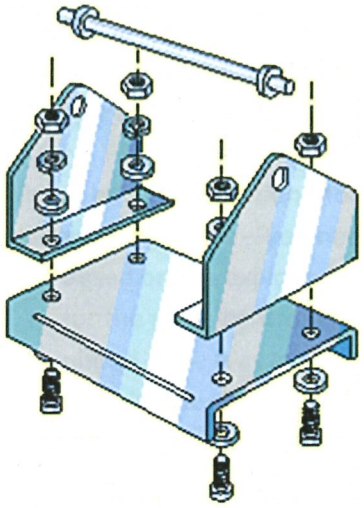
TUT / Department of Mechanical Engineering and Industrial Systems

TTE-50506 Assembly Technologies and Systems

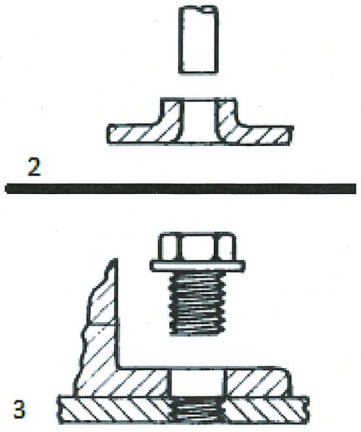
Exam 13.5.2014

- Use of extra material and calculator is forbidden. **Use of English dictionary is allowed.**
- Answer in short but complete essays **in English**
- Maximum points is 24 and you need 12 to pass the exam

1. **Modularization and DFA**
   a. What kinds of different motivations there can be for designing modular products? How modularization helps with these motivations? (3p)
   b. What does the term "DFA" mean? See the figures below and explain the difficulties of these products and parts regarding their assemblability. How would you improve the assemblability of these products and parts? What modifications would you do and why? (3p)

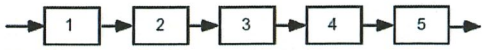


Product 1

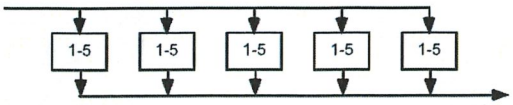


Parts 2 and 3

2. **Assembly system architectures and strategies**
   a. Compare serial line and parallel assembly task arrangements (see next page) against each other based on their tool cost, space requirements, reliability, time, flexibility, operator work content. (4p)
   b. What different strategies can be selected to cope with volume flexibility (varying capacity requirements) on assembly systems? (2p)



Series Task Arrangement



Parallel Task Arrangement

3. Equipment

a. Grippers: What things you should consider when selecting a robot gripper for your application? Name and shortly describe **five**, in your opinion, most important things. (4p)

b. What joining methods are applicable for joining two plastic parts? Shortly discuss the properties of the applicable joining methods and the requirements they put to part design and/or material selections. (2p)

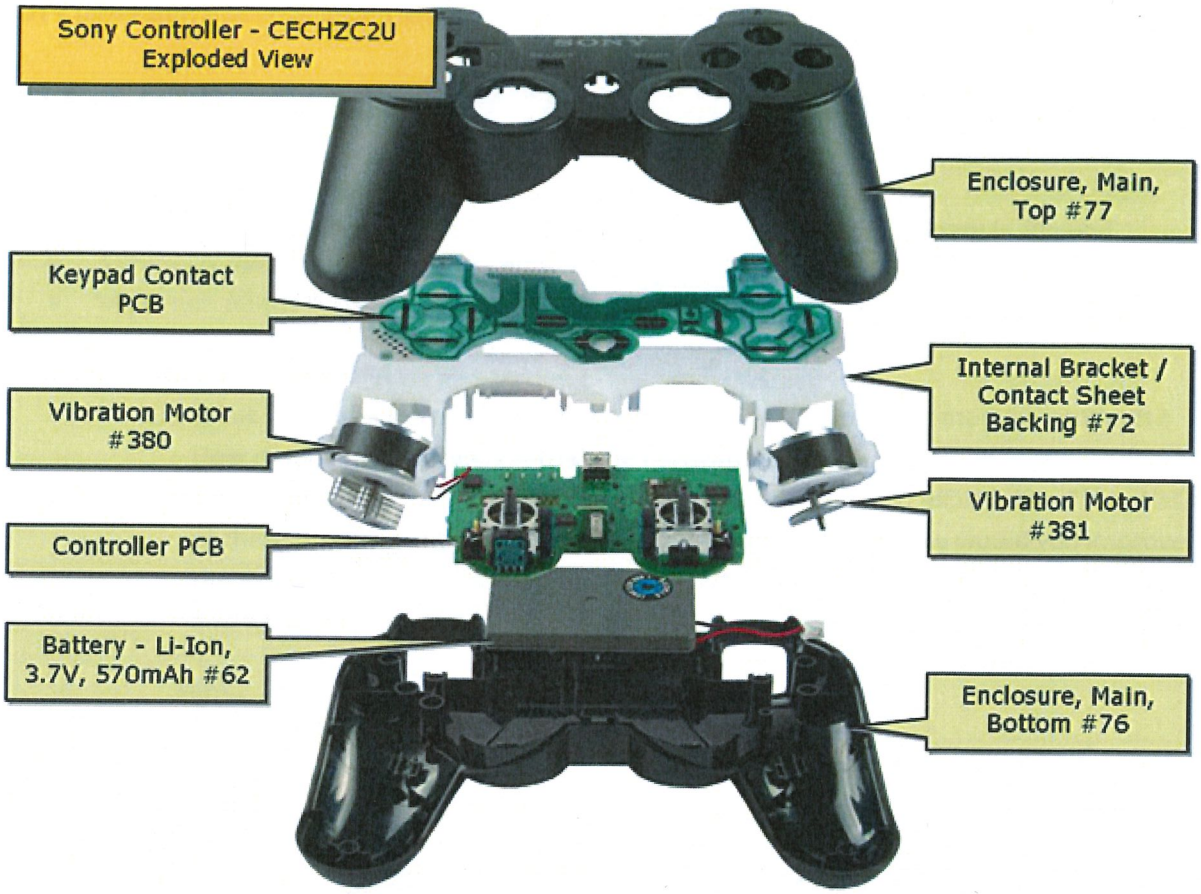
4. Case problem

On the following page you see an exploded view of a hand held game controller (image from http://electronics360.globalspec.com/article/2223/sony-ps3-cech-2001a-game-console-teardown). Please note the wires leaving Vibration Motor #380 and Battery #62! Figure does not show, but also Vibration Motor #381 and Keypad Contact PCB probably need to be connected somewhere – you need to figure out how (and when) these might be connected.

a. Based on the exploded view, make an assembly stage decomposition model (ASDM) for the game controller (on next page you find an example of ASDM for a mobile phone – use it as an example). As a part of the ASDM, you need to **specify in what stage(s) the circuit boards, motors and battery are connected.** (2p)

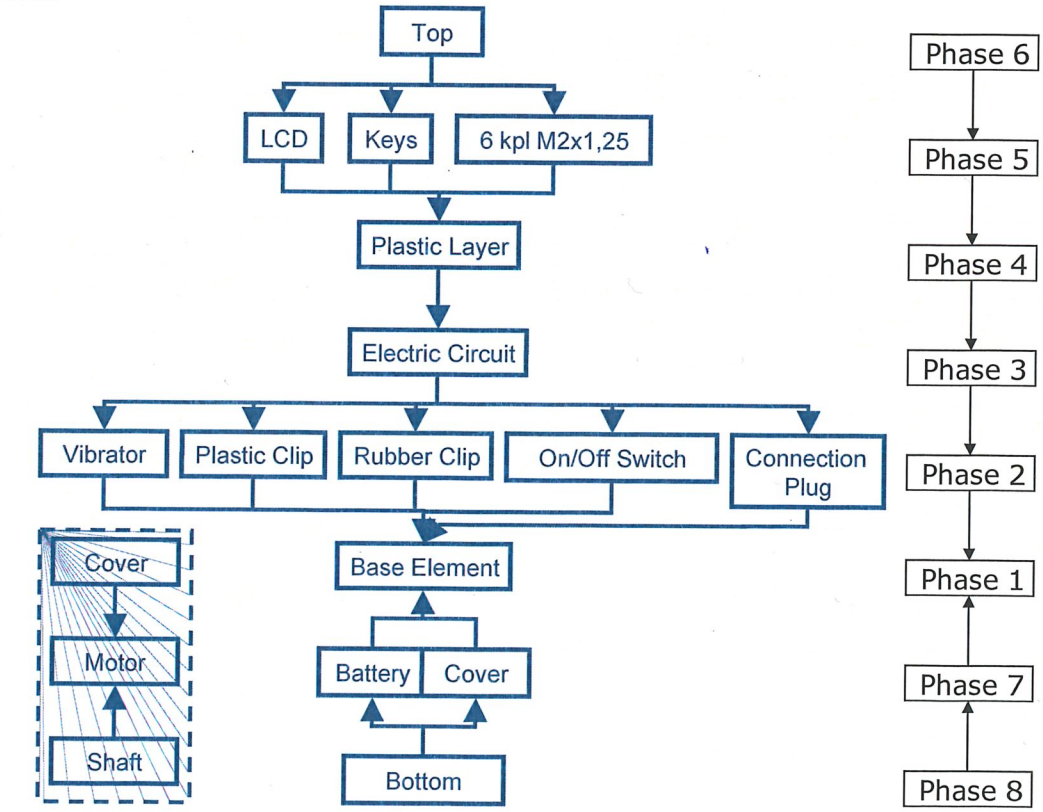
b. Based on the exploded view and the ASDM you made, sketch an assembly (manual/semi-automatic/automatic) system for this product (without any changes) assuming that new product needs to be finished every 30 seconds. Shortly discuss and justify at least the following points: (4p)

- How many cells?
- What operations are done in each cell?
- How the product is transferred between cells?
- What kind of equipment you would use in each cell?



Source: IHS

Example of assembly stage decomposition model. In the figure, "6 kpl M2x1,25" means 6 screws of size M2x1.25.



Subassembly of the vibrator